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THE LEVITT-MULLER ELECTRIC LIGHTING SYSTEM AND MULTIPLE CIRCUIT DYNAMO.

The deep and unprecedented interest in electricity which everywhere prevails, has stimulated our electrical inventors to great activity, and while it may be true that there are many failures to reach beyond a certain already attained economy and excellence, yet, taken all in all, electrical science is advancing steadily and surely, and occasionally an inventor outstrips his competitors, and produces something better than that which previously existed. Mr. Hans J. Müller, a prolific electrical inventor of this city, seems to have been very successful in this respect, having devised a new dynamo-electric machine which is claimed to be independent of existing patents. He has also invented new forms of arc and incandescent lamps, all of which work very successfully, and in many respects appear to be marked improvements.

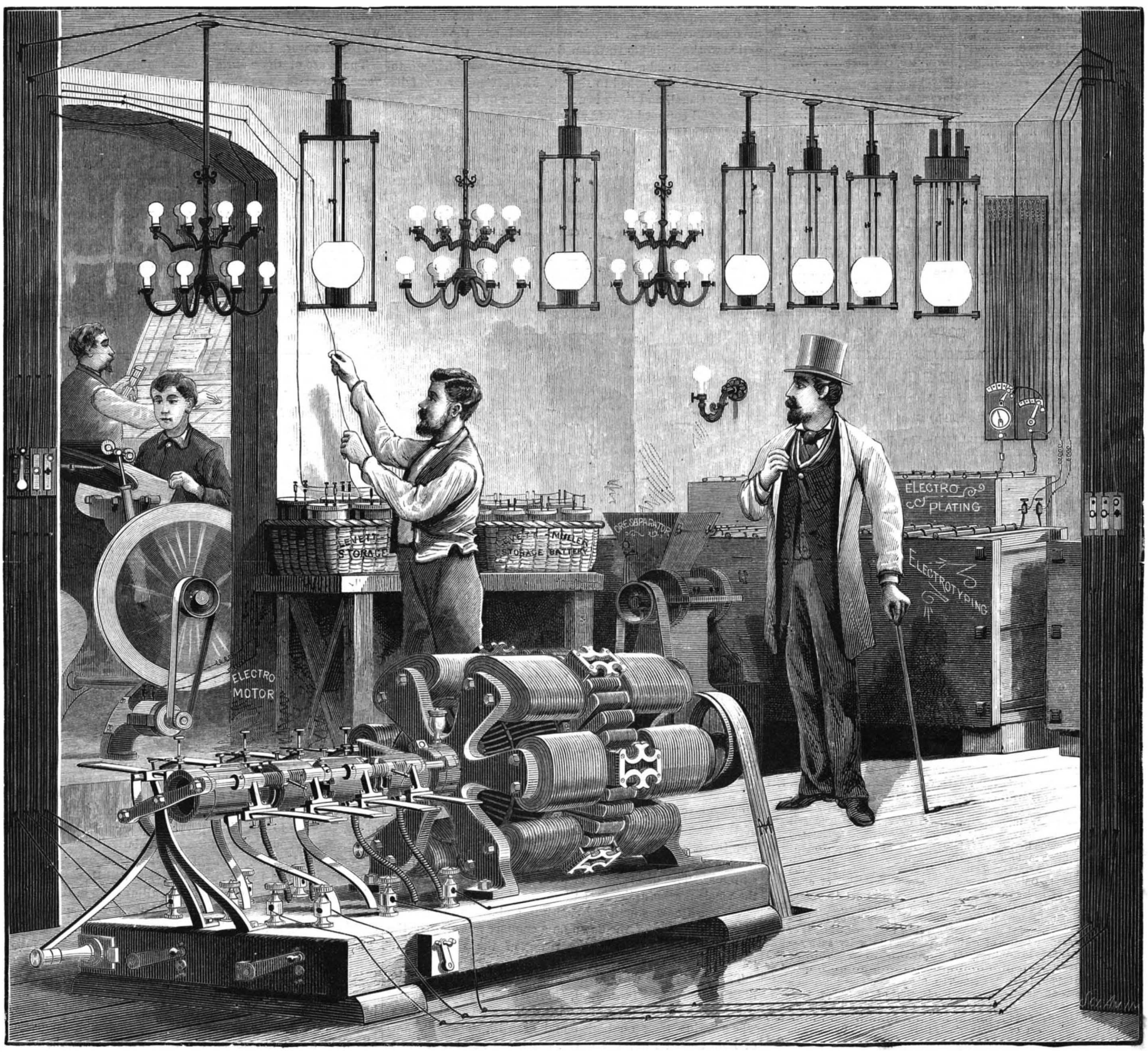
The new dynamo, which is shown in perspective in the foreground of our larger engraving, and in transverse section in one of the smaller engravings, is capable of yielding a number of separate and distinct currents which may be employed in widely different kinds of work. The dynamo shown in the illustration furnishes four separate circuits, with electric currents for as many different uses. One current is used for the arc light, another for incandescent lights, another for the transmission of power, another for electroplating. By simply duplicating some of the parts of the machine, the number of different circuits supplied may be indefinitely extended, and the currents may be used interchangeably for the arc lights, incandescent lights, electric motors, electroplating, storage of electricity, ore separating, and in fact for any of the purposes to which electricity is applied. The production of a number of separate and distinct currents in one machine is a novel feature claimed by Mr. Müller, and one that is of great utility. For example, by using one of these machines a hotel may have arc lights in the halls, offices, and in front, while its parlors and private rooms may be supplied with incandescent lights, and power may be furnished for its various operations of the kitchen and laundry. Similarly public and business buildings and private dwellings may be equipped, and steamers may be provided with arc lights for the decks and head lights, while the state rooms and cabins may be provided with the softer and mellower incandescent light.

This desirable result is secured by employing a series of armature coils or bobbins, A, in an armature wheel rotating between the poles of two powerful multi-polar field magnets, B, the several bobbins being divided into series, each series being connected with a series of commutator bars forming commutator cylinders, each being provided with a pair of collecting brushes, which deliver the current to the circuit upon which it is used.

To economize power the bobbins of the armature are arranged so that they are diagonal in relation to the poles of the field magnet. This plan allows the bobbins of the armatures to be removed from the vicinity poles of the field magnets with less force than would be required were the bobbins exactly radial.

The peculiar form of the armature wheel insures another important result—that is, the creation of a current of air throughout the machine which keeps all of the parts cool.

[*Continued on page* 114.]



THE LEVITT-MULLER ELECTRIC LIGHTING SYSTEM AND MULTIPLE CIRCUIT DYNAMO.

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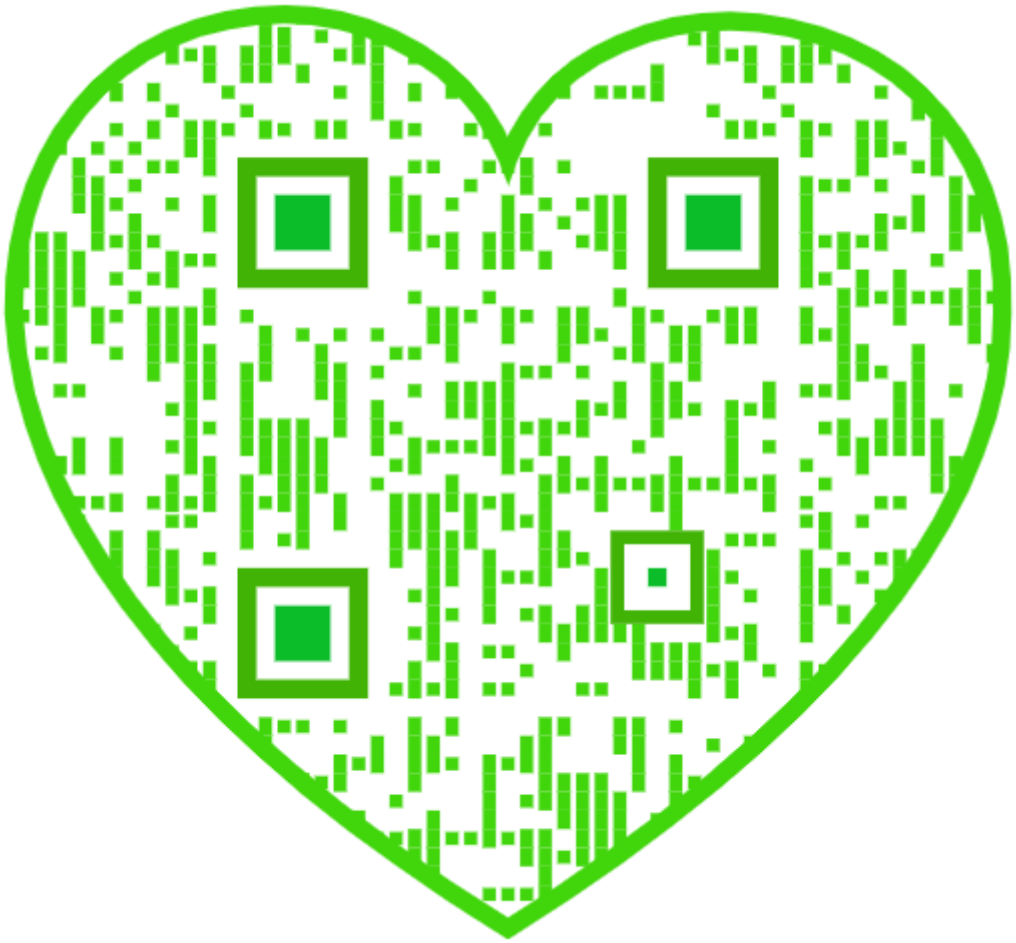

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THE WAR IN EGYPT.

The prospect of a speedy termination of the Egyptian difficulty does not improve. Indeed, it looks now as though England has on hand a serious war which is not likely to be brief, even if no general European complication arises from it.

Meantime the industries of Egypt are grievously deranged; trade is at a stand-still, all manufacturing operations are suspended, and agriculture is largely interrupted.

The geographical and the social characteristics of Egypt are peculiar, and of such a nature that war affects the country far more disastrously than would be possible in any other land.

The Europeans who have been driven out furnished most of the capital for all commercial and industrial enterprises, filled most of the positions requiring scientific knowledge or mechanical skill, and controlled the majority of the means for making productive and profitable the labor of the native masses. In their absence a speedy revival of prosperity is impossible, even if the war should end at once.

Within the past twenty years the agricultural products of Egypt have been nearly trebled by means of the capital and machinery introduced from Europe. The irrigation and consequent cultivation of vast areas of sugar and cotton and corn land have been made possible by the introduction of steam pumps and other modern irrigation machinery. Were the natives able to operate such machinery they can not now do so for lack of coal, and so to a serious extent they cannot produce the crops on which their prosperity depends.

The cotton-ginning factories and steam-presses, by means of which the cotton crop of Egypt has been made fit for profitable exportation, were introduced by Europeans and largely operated by them. The same is true of the sugar mills and the railways and other means of rapid and economical transportation. The natives themselves are incapable of operating the railways or of conducting an export trade, were such trade possible in Egypt in time of war. As a consequence the gathered crops are lying in the interior unsold; cultivation is largely suspended, and thousands of native workpeople are threatened with starvation.

The commercial and industrial arrangements incident to the war are not confined to Egypt. Even if no harm befalls the Suez Canal, and there is no suspension of traffic through it, England cannot but suffer severely, though indirectly, in her commercial and manufacturing interests.

Fully two-thirds of the cotton crop of Egypt, averaging 280,000,000 pounds, has hitherto gone to England. In the Bolton district alone five million spindles are employed on Egyptian cotton; and in the whole of England some twenty-five thousand workpeople are employed upon this staple. The stoppage of the supply cannot but affect them disastrously.

The large dependence of English industry upon Egyptian products is further illustrated in the case of cotton-seed, about nine million dollars worth of which is imported annually. Last year Hull alone took 120,000 tons, and in its crushing twenty-five hundred men and boys were employed. Still more serious will be the effect of the stoppage of the supply of Egyptian cotton-seed upon English agriculturists, who depend very largely upon cotton-seed oil-cake for feeding their cattle. The English soap-boilers use about fifty thousand tons of Egyptian cotton-seed oil a year, and must likewise severely feel a cutting off of the supply from that region. England also draws from Egypt annually six or seven million dollars worth of wheat and beans, three million dollars worth of sugar, and more than two million dollars worth of wool, ivory, gums, and other native products.

In return for all these, Egypt has taken manufactured goods, machinery, coal, and cotton fabrics, the producers of which cannot but lose heavily by the ruin which has fallen upon Egypt.

How far these English losses will react upon American trade it is impossible to foresee. The deficiency in cotton and corn can be made good from this side, but it is doubtful if any marked advantage will accrue to American producers unless the war should involve other powers than Egypt and Great Britain.

The first effect anticipated by our shipping merchants is an advance on ocean freight and in marine insurance through the withdrawal of first-class steamers for transport service to the seat of war, and the substitution for them of second and third-class freighters in the regular carrying trade.

A RECENT AURORA.

There was a superb exhibition of auroral light on the night of the 4th of August. We do not know how far over the country it extended, but from an elevated locality among the Connecticut hills the celestial show was beautiful in the extreme. The display commenced about 9 o'clock, when the whole northern sky was illuminated with a light of surpassing softness, singularly colorless and serene in aspect, like the breaking of the dawn on a summer morning, or the silvery light that attends the rising of the summer full moon.

The quiet phase was of short duration. The arch of white light widened and broadened, encroaching on the east and west, and touching the south with delicately penciled rays. The coloring took on bluish and greenish tints. Streams of light darted from the north, north-west, and north-east, reaching to the zenith, and dimming the luster of the bright stars, upon whose domains they ruthlessly intruded. Two brilliant streamers met above Arcturus, surrounding the ruddy star with a transitory corona; others threw their ethereal beams over the Great Dipper, the Polar Star, and Cassiopea, immersing them in a hazy light, through which the stars glimmered and twinkled in subdued brightness. The lesser stars ceased to shine amid the all-pervading glow, and a portion of the Milky Way, grandly defined in the earlier evening, was completely hidden from view.

The scene changed with every glance to the heavens. The streamers dissolved, new ones took their places, waves of brightness undulated over the sky, celestial banners were unfurled, and squares and triangles mingled in the celestial architecture, the varied forms making their rapid course over the sky, now uniting in vast masses, now breaking in pieces, now joining in bands, and now rolling out into vast draperies, with which to curtain the sky. About 10 o'clock the show reached its culmination with a grand finale in the northeast, in which the most brilliant features of the display were concentrated in the closing scene. The light was like that with which in high localities the sun sometimes irradiates a portion of the landscape while the rest is left in shadow. Thus the aurora lighted a hill-side in the distance, and thus this weird agent of the sun threw its beams through the trees in a neighboring pine grove, distinctly outlining their forms and gleaming like sunlight between their trunks and branches. A charming feature of the show was the fall of three meteors from the bowl of the Dipper. The first and third were of the ordinary kind, but the second was as large as a star of the first magnitude, and, as it exploded, left behind a train of crimson light, thus furnishing, for a few seconds, the one element that was wanting to the perfection of the exhibition. For, unlike the grand display of the 16th of April, in which all the hues of the rainbow were represented, the aurora was almost colorless, being white, slighty tinged with blue and green.

At 10 o'clock the moon made her appearance upon the scene, and, though in waning glory, her light was sufficient to break up the brilliance of the show. When, at the latest observation, she was nearly half way to the zenith, the northwestern sky had resumed its normal condition, though auroral banners were still faintly floating in the northeast.

The cause of these auroral outbursts is a question of universal interest. The sun is now passing through the maximum period of sun spots, and a condition of great disturbance agitates his fiery mass. It is generally believed that sun spots and aurora bear to each other the relation of cause and effect. No human being has ever yet found out why a storm in the sun is followed by a display of auroral light in our atmosphere. Nothing in modern astronomy is more desired than a solution of the mysterious relation existing between the sun and his family of worlds. For, doubtless, when our skies are illumined with auroral light, every planet in the system responds to the same all-pervading power. No one knows how many centuries of observation must pass before the key is found to solve the mystery. But, in some unexpected hour, light will break forth from the darkness, and the secret of the sun's physical structure will be comprehended.

FREIGHT CAR COUPLERS.

A correspondent, who has given much serious thought to the question of preventing the slaughter of railway men while making up trains, expresses the opinion that an automatic coupler for freight cars is a mechanical impossibility, so long as the present custom prevails of allowing each car builder or railway company to make the height of the coupling point whatever individual convenience or caprice may dictate.

The use of automatic couplers on passenger cars has been made possible by having the bumpers and coupling centers at the same level on all cars using the same coupling system. Corresponding uniformity in freight cars would make automatic couplings successful with them; and, in our correspondent's opinion, such uniformity of coupling level should be compelled by legislative enactment. He says: "Mine owners are compelled to sink expensive shafts and slopes, and to spend thousands of dollars in other ways, for the safety and health of their men. Why should not one class of men be protected as well as another, and by the same means—legislative—if the humanity or self-interest of employers does not lead them to do it? Once get uniformity in height of bumpers and coupling centers, and the successful automatic coupler will be easily attained, but without uniformity the time of inventors and committees of master car builders, and the money spent in their investigations, will be worse than wasted, for such efforts only delay the pressing of the subject to the vital point—uniformity in height of bumpers and coupling centers, particularly the latter."

Touching the alteration of existing cars, our correspondent says he has never seen any cars with low couplings where any serious mechanical difficulties were in the way of raising the coupling centers to make them correspond with cars having higher coupling centers.

If this opinion is correct the first step toward uniformity would be a general agreement with respect to a standard height for coupling centers for all new cars and all repaired cars which would readily admit of a change to the standard height or to something near it. The diversity which now prevents the use of automatic couplers would thus be gradually done away, at least on the lines which carry the great bulk of the freight of the country, and in whose busy yards most of the coupling accidents occur.

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Proposed Change in the Government Academies.

In their scope and spirit the government academies at West Point and Annapolis have given occasion for two serious objections. They are expensive schools, and each has a capacity far in excess of the present needs of the service it is intended to recruit. The national desire is that the army and navy shall be of the smallest dimensions. Both are already over-officered; yet these government training schools are annually graduating large numbers of cadets for whose services there is no demand. The appointment of cadet engineers at the Naval Academy has already been suspended under the provisions of the naval appropriation bill, approved August 5, and there has been serious talk of shutting up the academy altogether. On the other hand, both the Naval Academy and the Military Academy have been charged with a tendency to train up classes of young men to regard themselves as superior to the common run of civilian students. They are officers of the United States Army or Navy, and not to be rated with ordinary work-a-day people who have no ambition above civil life. If this prejudice had the effect of giving the young cadets nobler aims and broader views of their duties and responsibilities, it would be less unpopular; but it does not show itself that way. Hence the disposition of many people to question the utility of supporting the school any longer.

A better view of the situation has been taken by Lieutenant T. H. Stevens. Instead of closing the schools he would have their capacity more completely utilized; and the plan he suggests in the *United Service Magazine* seems to be equally well calculated to correct the tendency to professional narrowness in the spirit of the schools. His plan contemplates the admission to the Naval Academy of a large number of boys who should be at private expense for maintenance, as in private institutions of learning. The number of students should be such as to furnish graduating classes of at least a hundred. From this number he would have a few selected each year for naval officers from among those most fitted for and most desirous of entering the service. A similar plan would answer as well for the Military Academy. In this way, with very little, if any, extra expense the government would help to educate great numbers of young men, who would be valuable as citizens, and who would be in time of war especially well fitted to do good service as volunteer officers. Such an enlargement of the scope of the government schools would do much also to increase their popularity; and by furnishing a larger body of students to select from would enable the government to recruit the military and naval service with a superior class of young officers.

To our mind the advantages of the suggested change would not end here. The reflex effect upon the personnel of the army and navy, in preventing the development of that professional narrowness and conceit so apt to show itself among young men set apart early in life for a special profession carrying authority, and trained exclusively for official position with and by others having the same limitation of life purpose, would be largely prevented in officers educated primarily as civilians. With ties of student friendship reaching out into every department of civil life whither his school fellows have gone it would be impossible for the young officer to become the victim of professional bigotry and exclusiveness. And if the nation should again have occasion to put into the field its citizen soldiery, officered by men drawn from civil life, there would be little risk of seeing repeated the disgraceful and costly exhibitions of professional jealousy which so many "regular" officers showed in our late war toward those who had not been trained at West Point.

Hygiene for Horses.

Dr. C. E. Page gives the *Medical and Surgical Journal* some suggestions on keeping horses in health which are not only in agreement with the best teaching but sustained by his own and others' experience:

"The custom of working or exercising horses directly after eating; or feeding after hard work, and before they are thoroughly rested; baiting at noon, when both these violations of a natural law are committed: these are the predisposing causes of pinkeye, and of most diseases that affect our horses. Keep the horse quiet, dry, warm, and in a pure atmosphere, the nearer outdoor air the better, and stop his feed entirely at the first symptom of disease, and he will speedily recover. It has been demonstrated in tens of thousands of cases in family life that two meals are not only ample for the hardest and most exhausting labors, physical or mental, but altogether best. The same thing has been fully proved in hundreds of instances with horses, and has never in a single instance failed, after a fair trial, to work the best results. An hour's rest at noon is vastly more restoring to a tired animal, whether horse or man, than a meal of any sort, although the latter may prove more stimulating.

"The morning meal given, if possible, early enough for partial stomach digestion before the muscular and nervous systems are called into active play; the night meal offered long enough after work to insure a rested condition of the body; a diet liberal enough, but never excessive; this is the law and gospel of hygienic diet for either man or beast. I have never tried to fatten my horses, for I long ago learned that fat is disease; but I have always found that if a horse does solid work enough he will be fairly plump if he has two sufficient meals. *Muscle* is the product of work and food; *fat* may be laid on by food alone. We see, however, plenty of horses that are generously—too generously—fed, that still remain thin, and show every indication of being under-nourished; dyspepsia is a disease not confined exclusively to creatures who *own* or *drive* horses. But for perfect health and immunity from disease, restriction of exercise must be met by restriction in diet. Horses require more food in cold than in warm weather, if performing the same labor. In case of a warm spell in winter I reduce their feed, more or less, according to circumstances, as surely as I do the amount of fuel consumed. I also adopt the same principle in my own diet. The result is, that neither my animals nor myself are ever for one moment sick."

The Overflow Bug.

The following experience of Mrs. A. E. Bush, of San Jose, California, is given in *Nature*. The insect popularly denominated "overflow bug" in California is the *Platynus maculicollis*, Dej.

"We lived in Fresno county two years, in the northeastern part, and in the foot-hills of the Sierra Nevada. It is hot and dry there; no trees and many rocks where we were; thermometer ranging from 93° to 108° for about three months. In June and July, when hottest and driest, the 'overflow bugs' filled the air between sunset and dark; you could not with safety upon your mouth. They would light all over your clothes; they filled the houses, they swarmed on the table, in the milk, sugar, flour, bread, and everywhere there was a crevice to get through. Take a garment from the wall, and you could shake out a cupful. It was a veritable plague. In a shed where the boards had shrunk, and the cracks been battened, the spaces between the shrunken boards were packed full. They were flying for about two weeks, and then they disappeared mostly, or they did not fly much, but were hidden under papers, clothing, and every available place. In November, before the rains, they spread around but not to fly; make a light in the night, and you would see the floor nearly covered; lift up a rug and the floor under would be black, and they would go scuttling away for some other hiding. I had occasion to take up a floor board after they had apparently disappeared, stragglers excepted. The house was upon underpinning two feet or more from the ground. When the board was raised, there were the overflow bugs piled up against a piece of underpinning, making such a pile as a half bushel of grain would make. They were all through the foot-hills the same, and much the same in Los Angeles about Norfolk, but they did not fly much in the latter place. In Los Angeles they seemed to be worse before the 'Santa Annas,' a hot wind from the desert filling the air with sand; and though the chickens were ever so hungry for insects, they would not eat the overflow bugs You send for a sack of meal, and when you open it you see a handful of overflow bugs; in the night you put up your hand to brush one from your face, and then you get up for soap and water to cleanse your hand. In the morning, if you put on garments without shaking, you get them quickly off and shake them."

Ancient Works in Florida.

The *Travers Herald* describes the finding of an ancient work in the digging a canal between Lakes Eustis and Dora, to open up the more southern lakes of the great lake region of Florida.

The first excavations revealed the existence of a clearly defined wall lying in a line tending toward the southwest, from where it was first struck. The wall was composed of a dark brown sandstone, very much crumbled in places, but more distinct, more clearly defined, and the stone more solid as the digging increased in depth. The wall was evidently the eastern side of an ancient home or fortification, as the slope of the outer wall was to the west. About eight feet from the slope of the eastern wall a mound of sand was struck, embedded in the muck formation above and around it. This sand mound was dug into only a few inches, as the depth of the water demanded but a slight increased depth of the channel at that point; but enough was discovered to warrant the belief that here on the northwestern shore of Lake Dora is submerged a city or town or fortification older by centuries than anything yet discovered in this portion of Florida. Small, curiously shaped blocks of sandstone, some of them showing traces of fire, pieces of pottery, and utensils made of a mottled flint were thrown out by the men while working waist deep in water. One spear head of mottled flint, five and a half inches long by one and a quarter inches wide, nicely finished, was taken from the top of the sand mound and about four feet below the water level of the lake.

Hearing the Aurora by Telephone.

An observer of the recent aurora at Mont Clair, N. J. August 4, writes that on connecting the two poles of his telephone, one with the water pipe leading to cistern near his dwelling, and one with the gas pipe leading all over town, he heard the electrical crackle going on, substantially the same as is heard when the same connection is made during thunder storms. He however reports that the auroral crackle was more delicate in its sound than the thunderstorm crackle, and that beside the crackle there were at intervals of perhaps half a second each, separate short taps on the telephone diaphragm that gave a slight ringing sound.

A CLOCK was exhibited some time ago at Paris which fired a shot every hour. Somebody says that its great practical utility was "to kill time."

The Abatement of Smoke.

The Smoke Abatement Exhibition in London, just closed, was visited by 116,000 persons. The variety of apparatus exhibited was so great that about a thousand applications of the tests were necessary. The tests were conducted by Professors Roberts and Franklin. The chairman of the exhibition committee said when the prizes and awards were distributed that the exhibition had shown that smokeless kitchens were possible and could be fitted to any house. The consumption of gaseous fuel afforded the most promising solution of the problem how to relieve cities from the nuisance of smoke. The committee had decided, if they could find sufficient support from the public, to form an institute, among whose objects would be to promote the better utilization of coal and coal products—to determine practically and scientifically the means actually available for heating houses as at present constructed without producing smoke, by enabling the committee to examine the subject generally and report for public information.

The special Dr. Siemens prize of 100 guineas for the best utilization of coal was divided and awarded to the Dowson Economic Gas Company and the Falkirk Iron Company; the ladies' prize of 50 guineas for the best smoke-preventing coal-burning kitchener was divided between J. F. Constantine and the Eagle Range Company. A resolution to form a smoke abatement institute was adopted.

The Largest Leather Belts.

The largest belt ever made from a single width of hide is said to have just been made by the Jewell company of Hartford for a New York flouring mill. It is forty-eight inches wide, ninety-six feet long and weighs one thousand pounds. —[*Buffalo Express.*

The Hartford *Evening Post* says that the Jewells are now making two still larger belts than the above for one of the largest rubber factories in the country. One is 48 inches wide and 120 feet long, the other is 44 inches wide and 150 feet long, both double thickness. These are the largest belts that can be made from a single hide, as no hide can be solid and thick more than four feet in width. It is but a few years since belts of these proportions could be made, or pulleys on which to run them, and in no country but this is it done now.

The establishment of Messrs. Jewell is one of the most extensive and best organized in the world. In the production of good belting many processes are employed requiring great skill and experience. Those who wish to acquaint themselves with the details of this peculiar industry should examine the series of engravings and descriptions of the Jewell establishment published in the SCIENTIFIC AMERICAN of February 14, 1880.

Baking Powders.

The flourishing condition of the baking powder trade is evident from a glance at the advertising columns of domestic and religious papers. The cause is probably due to the fact that better results are obtainable with them than with their constituents used separately, and why? The best baking powders are made of cream of tartar and soda, mixed in equivalent quantities, some inert substance being added to keep them dry.

The cook or housewife used to buy the ingredients separately and mix them when she used them, and usually the results were satisfactory. As she trusted to measuring them in teaspoons of various sizes instead of weighing them, of course she sometimes got an excess of one or the other, and the bread was either "sour" or brown with soda. But another and worse difficulty arose, for the adulteration fiend invaded the cream of tartar can, and this article became of such uncertain strength that only a prophet could tell how little soda it would neutralize. This went from bad to worse, until some samples were found that contained no cream of tartar at all. This was the golden opportunity for the "baking powder" men, and they improved it well. While some tried to make a cheap article, others preferred to make a good one, and amid charges and counter charges of alum, acid, etc., they have gone on rolling up wealth for themselves, if not for their customers. For those who prefer making their own baking powder we offer the following receipt: Pure cream of tartar, 2 pounds; bicarbonate of soda, 1 pound; corn starch, 1 ounce. All the ingredients must be *perfectly dry* before mixing, and very thoroughly mixed. One teaspoonful is required for one pound of flour. If the materials are not pure, of course the result will not be satisfactory.

Magnesia for Wheat.

The author ranks magnesia along with nitrogen, phosphoric acid, lime, and potash. The proportion of nitrogen and of phosphoric acid increases in wheat from the time of blossoming to maturity. Lime, on the contrary, decreases, and does not seem to play a very important part in the production of the grain, but along with potash serves chiefly in the development of the straw. Magnesia is more important than lime in the formation of grain. The mean requirements of wheat in order to produce 40 hectoliters per hectare are: Nitrogen, 92 6 kilos; phosphoric acid, 37; lime, 25·2; magnesia, 12·2; and potash, 116 2 The "laying" of wheat and other corn is not due to a deficiency of silica in the stalks, but to a diseased condition, consequent on excessive moisture and deficient sunlight.—*H. Joulie.*

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THE LEVITT-MULLER ELECTRIC LIGHTING SYSTEM AND MULTIPLE CIRCUIT DYNAMO.

(*Continued from first page.*)

The arrangement of the field magnets, armature bobbins, and connections is such that no bad effects are experienced from induction, the current in one circuit having absolutely no appreciable effect on that of another circuit.

This machine in ordinary working makes about seven or eight hundred revolutions a minute, and the lamps supplied by it seem to burn with absolute steadiness.

The arc lamp invented by Mr. Müller has a novel air check which regulates the movement of the upper carbon. This, in connection with other new devices, renders the light very steady indeed. We show in our engravings two forms of arc light, one burning a simple pair of carbons and limited as to the time it will burn continuously; the other form, which is shown partly in section in Fig. 2, is of the same general construction, but made in duplicate, so that it will burn two, three, four, or more pairs of carbons in succession.

In this lamp, when the light-arc is very small, there is very little resistance in the circuit, and the helix draws its core inward, raising the free end of the lever, A, as far as the upper screw will permit. This causes a pawl to engage with the ratchet-wheel of the feeding mechanism, which is rotated a short distance in the proper direction to raise the positive-carbon holder and lower the negative-carbon holder, thus separating the carbon points. This operation is repeated every time the carbons approach each other too much. The rapid descent of the carbons is prevented by the piston attached to the upper or positive-carbon holder. The weight of the upper carbon and its holder, acting on the ratchet-wheel and its shaft, raises the lower carbon holder. As the positive carbon is consumed twice as rapidly as the negative carbon, the wheel which it moves must have twice the diameter of the wheel which moves the negative carbon. As long as there are any carbons in the first lamp, the current passes into the positive-carbon holder, the positive and negative carbons, the helix, the joint piece of the armature, and from there to the generator. During this time the armature at the side of the helix is attracted by the pole piece at the lower end of the helix. As soon as the first set of carbons is consumed to such an extent as to interrupt the circuit, the side armature is released from the pole-piece and is pressed against a contact-strip which sends the current through the second set of carbons. As soon as the second set of carbons is consumed the armature of that lamp is released in the same way, sending the current to the third set and so on.

It will be seen that by this ingenious arrangement a battery of lamps may be kept in operation for a very long time, in fact the light may be made practically continuous.

Mr. Müller's incandescent lamp is shown partly in section in two views in Fig. 3. In this lamp the inventor secures the following important results: First, replacing the carbon filament without breaking or rendering useless any part of the lamp; second, preventing the entrance of air through the joints between the plug and the conductors passing through it to the carbon filament.

The glass globe or bulb is provided with a flaring strengthened neck, fitting very tightly on a beveled glass stopper or plug, which is secured airtight by means of packing material in a hollow base, D, adapted to be screwed on or otherwise attached to a bracket or chandelier arm. The glass plug

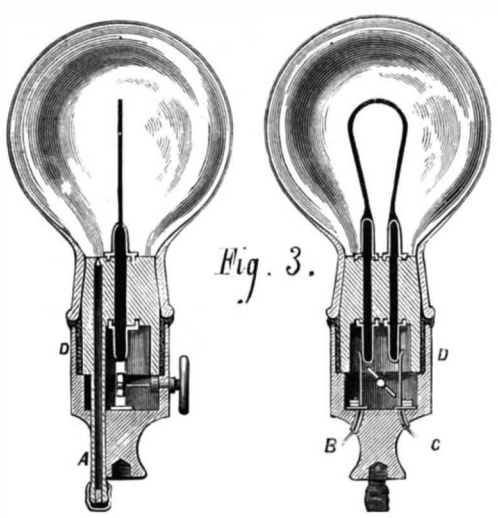

Fig. 3.

Fig. 3.—THE LEVITT-MULLER INCANDESCENT LAMP.

and the neck of the globe are ground together so as to fit air tight against each other. A packing is placed around the plug and the edge of the neck as shown. Two carbon conductors of suitable thickness are passed through longitudinal openings in the glass plug projecting from the top and bottom of the plug, and secured in the plug by a suitable cement forming airproof joints.

Copper rings are cast or blown into the top and bottom of the plug around the apertures through which the carbon conductors pass, and these rings project slightly from the ends of the plug. Copper is then precipitated by means of electricity around the projecting ends of the carbons and the rings. By this means the projecting ends of the carbons will be strengthened and prevented from being broken off, and the joint will be made airtight.

The upper ends of the carbons are provided with slots into which the ends of a carbon filament are passed and secured by means of a peculiar cement. A glass seal tube projects from the bottom of the plug through the base of the lamp, in which it is secured airtight by means of cement. The end of this tube extends through the plug, and is contracted at its upper end. This tube is stopped at both ends, and the intervening space is filled with mercury.

Two insulated spring-contact strips project upward from the bottom of the recess in the lamp base, and rest against the lower projecting ends of the carbons. These strips are connected with conducting wires, B C, leading to the electric

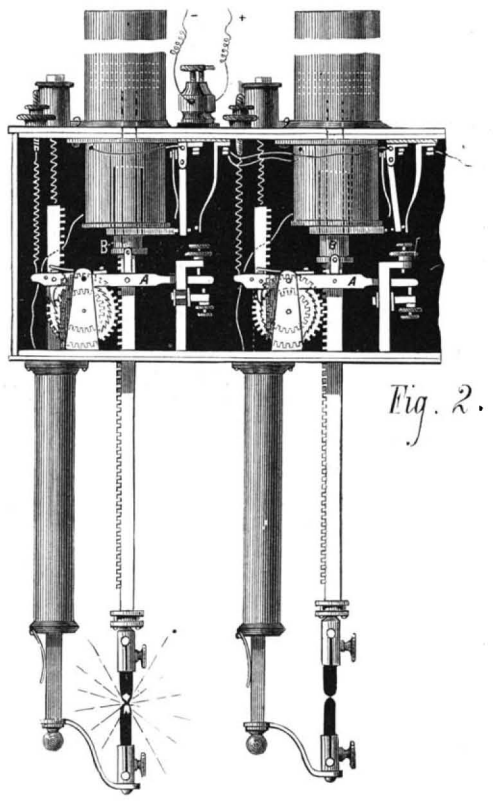

Fig. 2.

Fig. 2.—THE LEVITT-MULLER CONTINUOUS ARC LAMP.

generator. A key journaled in the lamp base has at its inner end a crosspiece, which is of sufficient length to separate the strips and remove them from the ends of the carbons when it is in a horizontal position. When this crosspiece is in a vertical position the strips are released and rest against the ends of the carbons.

Should the carbon filament be destroyed or broken the globe is removed, a new filament is inserted, the globe is replaced, and the air is exhausted.

In addition to these interesting inventions, Mr. Müller has devised a very successful magnetic ore separator, which is seen in the larger engraving beyond dynamo. He has also perfected a storage battery for which great advantages are claimed.

The headquarters of the Levitt-Müller Electric Light Company are at 540 to 546 West Sixteenth Street, New York city.

Reproduction of Written or Printed Matter.

As if the number of autographic presses and hectographs was not large enough to do all the copying required, new processes still continue to hail from Paris, the Yankeeland of Europe. This time it is J. J. Magne who has made an ink, or pencil, possessed of such qualities that a writing or drawing made with it, when dry, can be covered with a fatty ink, and the paper being saturated with a suitable liquid, it can be completely copied without being injured itself. Common printing ink acts toward this saturating fluid in precisely the same way as Magne's pencil, so that printed matter and cuts can be reproduced in exactly the same manner.

The liquid employed to saturate the paper consists of 150 parts by weight of acid (sulphuric is the best) and 350 parts of alcohol. If intended for autographic reproduction, 1,000 parts of water should be added. The proportions may be varied to suit the use that it is to be put to, but to prevent injury to the original, there must be plenty of alcohol.

Autographs for reproduction must be written with ink or pencil, of such composition that they can take up the fatty ink; the same kind is used for all kinds of paper whether sized or not. The portions of the paper not covered with ink are protected against the lithographic ink by an acid composition which repels the greasy ink, does not attack the cellulose, and, therefore, leaves the original perfectly unchanged.

The ink consists of proteine substances (albumen, caseine, fibrine, etc.), and of bichromated salts, alum, cyanides, etc. In making it there is dissolved a quantity of water two or three times as great as that of the albumen or other proteine substance, a mixture of two parts of a bichromate or alum, and one part of prussiate of potash. A certain quantity of albumen is also beaten up with an equal weight of water. The proportion of salts to that of albumen is about as six to one hundred. The two liquids are finely mixed intimately, and a suitable quantity of pigment added. The ink, which must have pretty deep color, is unchangeable, remains thin and fluid, and can be used with a pen, or pencil, or drawing pen, on any kind of paper, except that very heavy pasteboard or too thin silk paper cannot be used.

Pencils or crayons used in this process consist chiefly of paraffine colored with very fine lamp-black or ivory-black, or with any other very finely powdered pigment for other colors. When lamp-black is used the proper proportions are sixteen parts of lamp-black to one hundred parts of paraffine. To make pencils of different hardness the paraffine is melted and the color added, and then a certain quantity of ordinary rosin (colophony) is added, usually not over ten per cent. The mass is cast into candle moulds when in a semi-liquid state, and taken out when cold. These cylinders are then cut in pieces and wrapped in strong paper, or covered with wood like common lead pencils.

The method of taking a copy of what has been written or drawn is as follows: If the work was done in ink it is all ready to copy as soon as it is dry. If it is done in pencil the drawing must be steamed a few seconds by simply holding it over a vessel of boiling water. After being air-dried it is carefully floated, face upward, on the acidified alcoholic liquid. There it is left until thoroughly saturated, and then it is spread out on a sheet of glass or smooth board, and inked with an ordinary lithographic roller. All the letters and lines will be covered with the greasy ink. As soon as it is supposed that it is sufficiently inked it is carefully pressed with a damp sponge on those places that have taken the ink, and then washed with water. To remove the excess of moisture, it is spread out on a plate of plaster of Paris, and then transferred to a stone or zinc plate, and the copy taken. The precautions necessary in order to preserve the original copy are to wash it with carbonate of ammonia, or of soda, rinsing with cold water, removing the excess of water on a plate of gypsum or blotting paper, and then drying it in the press between sheets of porous paper.

To reproduce anything that is printed with printer's ink, the following method is pursued: The mixture of alcohol and acid is applied either to the face or back of the print with a brush. The liquid instantly penetrates the paper; the surface is then quickly washed off and the sheet carefully spread out on a dampened plate of glass or wood. There it is inked with an ordinary lithographic ink roller, gently washed to remove the excess of acid, dried on the gypsum plate, put on the stone and a sufficient pressure applied. The transfer of the negative is finished, and the ordinary lithographic process begins.

If both sides of a drawing or manuscript is to be copied, both sides are blackened, one after the other, the operation being carried out on one side as far as the transfer to a stone, and then the other side is inked and transferred. When copies of printed matter are to be made by this process, the negative is transferred to a polished zinc plate and then etched in the usual manner with acids.—*Deut. Industrie Zeit.*

Treatment of Scars of the Face.

A most important branch of cosmetic surgery is treated by Dr. C. L. Bull, of New York, in a reprint from the Transactions of the Ophthalmological Society. He says: "Persistent rubbing and kneading of scars of the face, both those due to burns and those resulting from bone caries, as

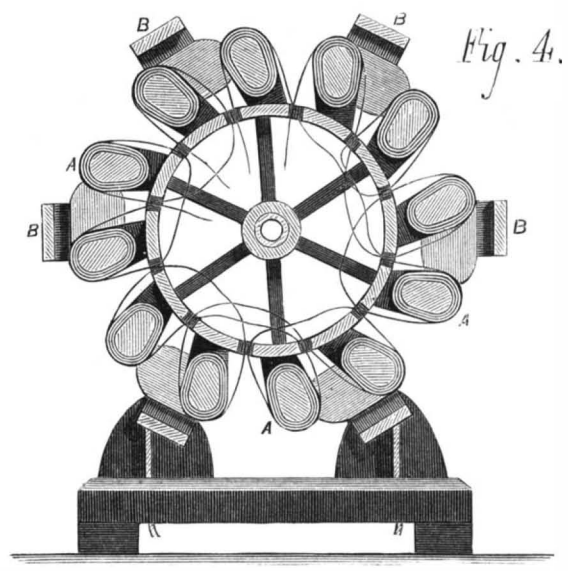

Fig. 4.

Fig. 4.—TRANSVERSE SECTION OF THE LEVITT-MULLER DYNAMO.

preparatory to blepharoplasty, have, in a number of instances in the writer's experience, yielded most excellent results. Adhesions of scars, slight or extensive, to the subjacent parts, have been slowly, cautiously, and painlessly detached, and a gradual absorption of the firm material in the dense part of the scar has been brought about. So considerable has been the result obtained in some cases that the writer has come to regard this gradual extension and loosening as an important part of the treatment in these cases." When one reflects on the amount of mental misery these scars often cause, their removal becomes an object of great importance.

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The London Fisheries Exhibition.

Congress having appropriated $50,000 for the collection, transportation, and display of objects representing the fishing interests of the United States at the International Fisheries Exhibition at London, next year, Commissioner Baird has issued a circular describing the character of the exhibits desired and the proper way of forwarding them.

Two classes of articles will be carried to London for exhibition, viz. : First, those which make up the "collective exhibit of the United States," and second, those which are entered for competition.

In the collective exhibit will be shown, in a systematic and synoptical manner, illustrations of our marine and fresh-water animals of economic value, together with the apparatus and methods of their capture and utilization, and the commercial, scientific, social, historical, and legislative aspect of the fisheries. It will include the most striking features of similar exhibits made by the Fish Commission in the Philadelphia Exhibition of 1876, and the International Fishery Exhibition at Berlin, in 1880, together with many additional ones never previously attempted. The major part of this display will be borrowed from the collections of the National Museum in Washington, but it will be necessary to secure a considerable number of new objects.

It is considered especially desirable that the department of competitive exhibits shall contain a very complete representation of the various food preparations of fish—canned, dried, pickled, smoked, etc.—there being a constantly increasing demand in England for goods of this description, shipments to that country amounting, in 1881, to more than $2,000,000, in addition to the very large exports to other parts of Europe and to the European colonies in the East. Manufacturers of boats and boat-fittings, angling apparatus and costumes, and other similar articles, are also urged to contribute. Medals in gold, silver, bronze, and diplomas of honor will be awarded by a jury of experts. Professor Baird is prepared to act, both in this country and in London, as the representative of individual exhibitors, and to attend to correspondence relating to applications for space, etc.

Goods to be exhibited, if delivered in Washington, Philadelphia, or New-York, will be carried to London and installed at the expense of the Government; special arrangements may be made for the return of articles at the close of the exhibition. Prospectuses, blank application forms, blank "lists of exhibits proposed to be shown," and any information desired will be furnished on application to the Commission at Washington. Applications for space for competitive displays should be made before the 1st of September, 1882. The exhibition—which is under the patronage of the Queen of England and the Presidency of the Prince of Wales—will be opened on the 1st of May, 1883, in buildings now being erected in the Horticultural Gardens at South Kensington, and will continue for a period of six months.

NOVEL DOOR SECURER.

We give an engraving of a very compact and convenient device for securing doors. It is designed principally for the use of travelers, and is very readily carried, and quickly

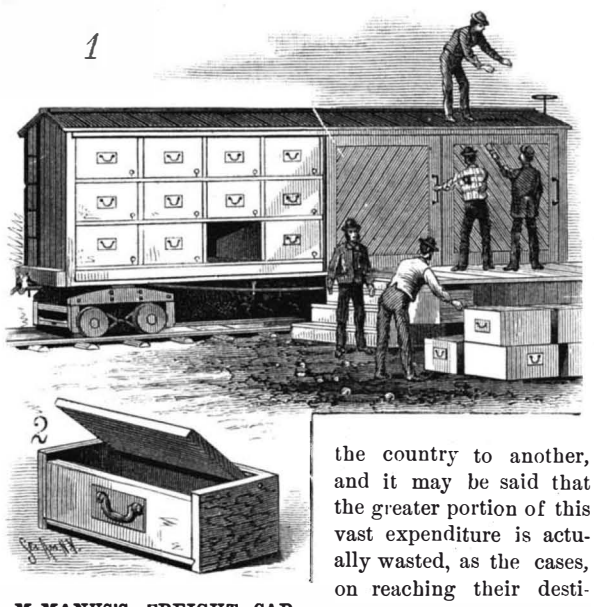
PORTABLE DOOR SECURER.

and easily applied to the door, and when so applied renders the door perfectly secure. The fastener is nicely finished and nickeled, and weighs complete only one and one-half ounces. It is provided with a morocco case, in which it is placed when not in use. A metal strip is provided at one end, with a flat hook, and a screw threaded rod is pivoted to its opposite end. A U-shaped piece, whose shanks are of unequal length, is apertured to receive the threaded rod, and the ends of the shanks of the U-shaped piece project toward the hooked end of the strip. This piece is secured in any desired position on the rod by a milled nut screwed on the outer end. The ends of the U-shaped piece have a flat, smooth surface to rest against the surface of the door and frame. The shorter shank is adapted to rest against a moulding or casing, and is provided with a swinging leg of such length that when it is swung outward its end will be flush with the end of the long shank. When in use, the hook of the metal strip is placed against the jam of the door, and the U-shaped piece is turned in such a manner as to permit the closing of the door, and by closing the door the hook is forced into the wood of the jam. The U-shaped piece is then turned so that the long shank will rest against the surface of the door. The device does not mar the door, and keeps it perfectly locked, and is applicable to doors of any thickness, having any style of casing.

This invention has been patented by Mr. Charles A. Crongeyer, of Detroit, Mich. Further information may be obtained by addressing Messrs. Crongeyer & Busch, Lock Box 643, Detroit, Mich.

IMPROVED FREIGHT CAR.

Hundreds of thousands of dollars are annually expended for packing cases in which to ship goods from one part of



McMANUS'S FREIGHT CAR.

the country to another, and it may be said that the greater portion of this vast expenditure is actually wasted, as the cases, on reaching their destination, are found, in many instances, to be worse than useless, and are consequently destroyed. This, together with the fact of the injury to certain classes of goods, in the ordinary methods of handling and shipping, and the trouble and expense of packing and unpacking goods in the ordinary way, has led to the invention shown in our engraving.

The cut shows a freight-car divided horizontally by two platforms or partitions, forming three longitudinal compartments, which are subdivided by vertical partitions forming small chambers for receiving a series of packing cases of uniform size and shape. The sides of the car consist of sliding doors, which may be moved so as to expose either half of the car, or, in fact, any portion of it.

The packing boxes are of sufficient thickness to properly protect the merchandise packed in them, and are of such size as to be conveniently handled. They are provided with handles on opposite sides, and have hinged covers by which all the trouble of nailing and removing nailed covers is avoided.

The cases can be furnished to merchants, who can fill them with goods and deliver them at the freight stations. The receiver of the goods can unlock the cases and remove the goods, and the cases, at a slight expense and without injury, may be returned to the shipping point. All of the cars are to be provided with compartments of uniform size, and any case will fit any car.

As the compartments extend entirely through the car, the load may be readily taken from either side of the car; the arrangement also permits of double length boxes for special classes of merchandise. Of course a car may be fitted with the compartments and cases in one half, only leaving the other half as a plain box-car.

Fig. 1 shows the car as it appears while being loaded or unloaded, and Fig. 2 shows the packing case in detail.

This invention has been patented by Mr. Edwin McManus, of Randolph, N. Y.

Theory and Practice.

Theory and practice, says the *Chemiker Zeitung*, will involuntarily strike the ear of some of our readers like shrill discord.

"All theory, dear friend, is hoary," perhaps one will say, while the theorist, wrapping his toga proudly about him, will draw aside from the practician with a sympathetic smile and express *his* ideas. The contradiction herein expressed has become so customary that one rarely meets with any other conception than this which is decidedly false. For this reason we may be permitted to state in a few words what is the real relation between theory and practice.

We do not see in it any contradiction, any "master and servants," or "head and hand;" nay, we look on them as two perfectly equal factors, through the harmonious co-operation of which the acquisitions of science are first made to serve mankind. If we admire the learned who live only for science, pondering on the highest problems for their own sake alone, unconcerned as to whether their thoughts can find any practical use, we do not honor less the man who is quick to see which thoughts of that savant promises a rich return if carried into practice, and then with an iron energy carries it out, and impresses upon it its best form.

And where is there any discovery which owes its origin to the mind of a theorist, that has not found its first complete application in the efforts of a diligent practician?

We have seen a whole series of discoveries, which seemed originally to have merely a scientific value, but they soon celebrated unexpected practical triumphs; we have seen how flourishing industries have been built on small and unseemly experiments made only for scientific purposes in the laboratory of the investigator, not only without regard to their practical utility, but very frequently without any suspicion of it. About two decades ago Bunsen and Kirchhoff astonished the world by their discovery of spectrum analysis, but at that time no one imagined that it would so soon find an eminently practical and genial use in the manufacture of Bessemer steel.

The insignificant observation that the legs of a frog hanging on a copper wire would jerk whenever they touched the iron, was the foundation of the electric telegraph, and there is scarcely another domain in which practical men have attained such brilliant results as in electricity.

Marggraf's ever memorable isolation of the "sweet salt" in the beet was the corner stone of one of the most flourishing industries of Germany, which to-day supports very many chemists and technical men who are continually striving to advance the higher development of this branch of industry.

What a wide step from Zinin's conversion of nitro compounds into amides to the present state of the coal tar color industry!

We could give an enormous number of examples of how small theoretical beginnings have risen to important practical results. But these few may suffice to show how everything of importance which has been accomplished in our profession owes its results to the circumstance that theory and practice have mutually supplied each other's deficiencies.

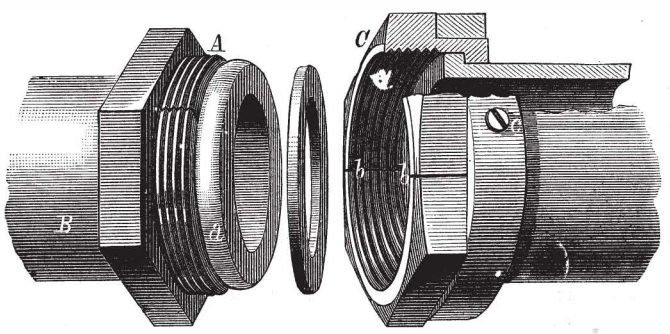
FREY'S PLUMBER'S COUPLING.

The great difficulty with plumbers' couplings used in connection with bowls and tubular connections of porcelain, glass, or other brittle material, is that they are difficult to apply, and can be applied and removed only with the risk of breaking the bowl or connection.

A ring or sleeve, A, having an external thread and divided into two or more longitudinal sections, is put on or around the branch, B, of the bowl. This ring is made somewhat larger in diameter than the collar of the bowl, and to receive a nut which holds the sleeve together and in place. The screw collar, C, of the coupling fits over the collar of the bowl, and screws on the split sleeve, A, bringing the flanged end of the pipe against the rubber packing ring by which the joint is made tight.

The split sleeve is prevented from turning when the joint is made by means of a tool fitted to the slits between the halves of the sleeve, or by means of a rubber band slipped over the collar, *a*, of the bowl.

In some cases it may be desirable to place the collar, C, on the branch, B. This collar is then split as shown at *b*, and



NEW PLUMBER'S COUPLING.

the two halves are held together by a ring, *c*, which slips over the smaller diameter of the collar, and is secured in place by two screws. In cases where two flanged pipes, or connections of porcelain glass, or even iron or other material, require unity with a strong tight joint, and when it is impossible or inconvenient to apply the ordinary coupling, both the sleeve, A, and collar, C may be divided as described. In this case also the two parts may be readily separated by taking the ring *c*, from the divided collar, C.

It will be seen that this device admits of applying a positive and reliable coupling where cement joints have heretofore been used, and it will prevent the breakage of many expensive pieces of work in plumbing.

Further information in regard to this useful invention may be obtained by addressing the inventor, Mr. J. J. B. Frey, 1283 Broadway, New York city.

The Telephone at Alexandria.

It appears that just before the bombardment of Alexandria arrangements had been completed for the introduction of the telephone in that city. The work had been done by Mr. H. H. Eldred, formerly station agent at Passaic City, N. J., who was at Malta during the bombardment, and conducted the experiments by which the firing was heard through 1,000 miles of ocean cable. The experiments were suddenly terminated by the explosion of a shell from one of the 81 ton guns in the cellar of the Alexandria central office.

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On Earthquakes.

BY C. W. C FUCHS.

It has been repeatedly noticed that of late years the interest in earthquakes is increasing. Every step of progress in this domain presupposes an exact knowledge of facts, and the more zealously observations are made, the richer and more reliable will be the supply of material that we have to work with. Scarcely a decade has elapsed since there were at most not over two or three persons engaged with this branch of geology, while now there are in all civilized countries professional co-workers that take part in these investigations, and that are in communication with all classes of people, so that they obtain information from all quarters, even the most retired. Within the last two years attempts have been made in many countries to replace these single and isolated efforts by methodical investigations that embrace the whole country, by giving a formal invitation to the whole population to take part in this investigation of earthquakes. The movement was started in Switzerland, and now we are in the fortunate position of being able to announce the first important results of such an organization. ("Les tremblements de terré etudies par la commission sismologique suisse de novbr., 1879, à fin decbr., 1880, par F. A. Forel.") Any one who has before him this abundance of connected statements regarding the trembling motions of that little country, and from it can easily read a number of the peculiarities of earthquakes, can form no adequate idea of the trouble and patience formerly required of isolated observers to obtain a few meager and often very inaccurate facts, and to make use of them in advancing our knowledge of this class of natural phenomena. We can not suppress a melancholy recollection of the insufficient means that we were compelled to make use of for so many years. Of course we cannot hesitate to acknowledge that there is scarcely any other country but Switzerland where such an organization could be as successful as in that country of freedom and independence, where persons are to be found in all strata of people, even in the most distant mountain districts, full of zeal to aid and sustain a purely scientific undertaking of this sort.

During the thirteen months embraced in this report of the committee there were twenty-six earthquakes. Many of these, usually the feebler ones, consisted of a single shock, while in the more violent and extended ones several shocks succeed each other. It was often possible to distinguish one principal shock and a number of secondary ones, as if the strata that were shaken by great force had afterward received other small cracks and breaks.

The surface affected by each earthquake varied in diameter from less than 4 miles to more than 350 miles; thirteen extended less than 3⅛ miles, ten were between that and 100 miles, and three had an extent of 100 to 330 miles.

The small earthquakes were quite evenly distributed over the whole of Switzerland; of the three largest, that of December 4 and 5, 1879, extended over Savoy, the Jura mountains, and the Swiss hills as far as Constance. It consisted of three principal shocks, followed by seven smaller ones. The first occurred at 5:35 P.M., December 4, and the third at 2:31 P.M., December 5. The center, from which the movement proceeded, changed several times. The next large earthquake was December 29 to 31, 1879, and consisted of three principal shocks and twelve secondary ones. The third was from July 3 to 5, 1880, and was of a very complicate nature. There were two very violent shocks July 4, one at 9:20 A.M., the other at 8:30 P.M., that were felt throughout Switzerland. Passing over the details of these, we come next to the question of time. The limited time that has yet elapsed since observations were begun, and their limited extent, do not yet permit of our saying at what season of the year, or what hour of the day, they are most frequent, and whether they coincide with flood-tide, thunder storms, etc.

At present the most perfect method of studying earthquakes is the one in use in Italy; the credit of it is due to De Rossi, of the Papal Academy at Nuovi Lincei. Posts for observation are scattered about on the most suitable spots like meteorological stations, and provided with physical instruments of the most varied character, which not only show the occurrence of very slight shakes, but also the form of motion, its direction and speed, in fact a true picture of what is going on in the earth. Some of the results appear in the *Bolletino del volcanismo Italiano*, and others in the Proceedings of the Pontifical Academy at Nuovi Lincei. (Similar observations are now being made in Japan.) We have every reason to expect valuable scientific results from this undertaking, but as yet they are only partially of use to us.

Under the term "earthquake" we understand the perceptible motions of the ground, and, as yet, it is these alone that are studied almost everywhere. But as the stations established by De Rossi report the feeblest "microseismic" vibrations, we cannot identify these oft observed phenomena with ordinary earth shaking without any further qualification. It is, indeed, possible that these investigations may lead to an entirely new field of science, electrical, magnetic, or what not, but belonging rather to physics than geology.

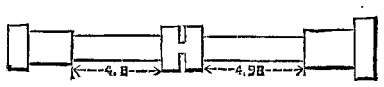
Excluding these slight tremors, and limiting ourselves to those which are perceptible shakes, we find that in 1881 there were 244 such shocks recorded in Italy, of which 86 were in winter, 61 in the fall, 56 in spring, and 41 in summer

The largest earthquake in 1881 was that of Chios. It began April 3, at 1:30 P.M., and the first shock was so violent as to destroy the greater part of the city of Castro in a few seconds. The soil appeared, as an eye witness expressed it, to actually dance from the powerful subterranean shocks. A second one soon followed and completed the destruction. It affected not merely the whole island, the southern part of which suffered most, but the opposite islands of Asia Minor were stricken too, so that the town and military harbor of Tschesme were half destroyed. There were 10,000 wounded and 4,181 killed, and it lasted six days, in which time there were thirty or forty shocks, each one of which was sufficient to destroy almost everything. On April 10 there were seven violent shocks, and then they became less frequent and weaker, but on May 20, June 10, and August 27, there were shocks powerful enough to level whatever buildings had been left standing. Even at the end of November they were still noticed.

The earthquake of Ischia also belongs to the class of large ones, 150 men having been destroyed, together with whole streets in Casamicciola. It was entirely local in character, being confined to the vicinity of Casamicciola and Lacco. It began at 1:05 P.M., March 4, 1881. There is scarcely any doubt that it was caused by the underwashing of the numerous hot springs in the vicinity of the extinct volcanoes, Monte Rotaro and Epomeo. Others of importance are the one that occurred August 10, at Osogna, when a thousand houses fell; and a smaller one between Taebris and Khoe, August 28.

Properties of Mild Steel.

At the recent session of the Iron and Steel Institute a paper was read by Mr. Edward Richards on the well worn subject of the properties of mild steel, and it detailed at considerable length a number of experiments carried out by the author. One object had in view was the determination of the work in foot pounds done in testing a specimen, and the formula deduced from results obtained in testing one specimen by the author was $u = 0{\cdot}90\ P, l$. Another sample of very soft ingot metal made for tin bar purposes, and having a tensile strength of 25 tons per square inch, gave results which would also agree with the formula $u = 0\ 90\ P, l$. Soft Bessemer steel having a tensile strength of 31 tons per square inch gave the formula $u = 0\ 89\ P, l$. The mean of the three soft qualities of steel gives 0 90 as the coefficient; and this was confirmed by the results obtained in testing some Siemens steel plate having a tensile strength of 32 tons per square inch. In the formula $u =$ the mechanical work, P is the tension in pounds, l the elongation reduced to forms of length. Another question to be settled by these experiments was the effect of sudden change in the form of a specimen. In one there were two cylindrical portions, each 4 inches long by 1⅛ inches diameter near the ends, and a central portion between them 4 inches long by 1⅝ inches diameter. A narrow groove, three thirty-seconds of an inch in width, was turned in the middle of this boss, so as to leave the diameter of the specimen at the bottom of the groove 1 inch in diameter. The sectional area of the specimen at the groove was upwards of 20 per cent less than at the ends, and the form of the specimen would at first sight appear to be highly favorable to fracture across the groove. The result of tensile test, however, proves the contrary; the metal is perfectly homogeneous, yet the specimen breaks, not at the groove, but at one of the ends, because the metal in the notch has not room to contract in area. It has been remarked by Dr. Siemens that "it is possible by careful manipulation to raise the breaking strain of a bar of a given sectional area to a remarkable extent by gradually accustoming it to the strain. By taking a bar of mild steel of 1 inch square sectional area, and loading it with a weight of, say, 15 tons, and leaving the weight on twenty-four hours, it would be found that the elastic limit and the breaking strength of the bar were materially increased." The author's experiments did not confirm this view, but the contrary. Other experiments described prove that the elastic limit of a steel bar varies according to the treatment of the bar previous to testing, and the tensile strength depends upon the cohesive force, and the amount of contraction of area at the maximum strain, the latter quantity being affected by the form of the specimen and by previous strain. In one sense these experiments go to support the opinion held by Dr. Siemens that any mechanical treatment to which mild steel is subjected has invariably the effect of increase of strength. Mr. Adamson and Mr. Wrightson made a few remarks on this paper, but there was no discussion. Mr. Bauermann, however, pointed out that we have probably two factors to deal with in breaking steel, namely, the force required to separate the crystals from each other, and to break any crystal through its own substance. It was not known whether the steel crystal had or had not a cleavage; nor could any one tell what force was required to part a crystal.



Wintergreen Oil in the Blue Mountains.

A letter from the village of Point Phillips gives us in the *Confectioners' Journal*, this account of a peculiar industry:

That long sandstone ridge, called the Blue Mountains, which runs past our village, is remarkably productive in huckleberries, foxes, birch, and wintergreen. In the heat of summer it yields its berries to thousands of pickers; in the cold of winter the hunters track the wily fox, and during all the year the luxurious growth of wintergreen and sweet birch gives employment to numbers of earnest men, who take up their dwelling in the woods and manufacture therefrom the oil of wintergreen. Public attention has lately been called to this humble industry by the activity of the internal revenue officers, who have descended, so to speak, upon these camps, and exacted a large and burdensome tax. Congressman Mutchler, in a recent speech, properly alluded to such a system of espionage as not only obnoxious to the people, but a disgrace to our civilization. Perhaps, then, a brief description of the process of manufacture of oil of wintergreen and the manner of life of those who make it may prove interesting to the reader.

Two men are necessary to carry on the business, one to work by day and the other by night. They build a hut wherein to dwell and sleep. One sleeps from 11 o'clock in the morning until 6 in the evening, and the other from 11 in the evening until 6 in the morning. During the forenoon they work together in collecting the wintergreen or birch. The sweet birch is generally used to produce the oil unless wintergreen is very plentiful. Bushes and branches are cut and chopped into small pieces, while from larger pieces the bark only can be used, and must be carefully shaved off. About half a cord of this material is collected and used every day, and from it a pint of oil or thereabouts is manufactured. The apparatus consists of a furnace, a boiler, a tin pipe, a trough, into which water is continually brought from a mountain brook, a barrel, and a glass jar. The furnace is made of loose stones, so arranged that the fuel is put in at one end, and the smoke goes out at the other through an old piece of stove pipe. Over the furnace is the boiler, which is merely a wooden box about three feet wide, four long, and three deep, with the bottom covered with sheet iron to prevent burning. The boiler has a wooden lid, so that it can be tightly closed, and from the top leads the tin pipe. This pipe runs into the water-trough and through it, so that the water always surrounds and cools it. The end of the pipe, after coming out of the trough, opens over a barrel, and in this barrel, exactly under the end of the pipe, is placed the glass jar. This constitutes all the plant.

The process of manufacture is now the following: The boiler is filled about a third deep with water, the birch bark and twigs are shoveled in until it is full, the lid is put on, and the fire started in the furnace. For hours the fire must be carefully watched and fresh fuel continually furnished. The material in the boiler becomes hot, the oil in the twigs comes out and mixes with the water. Finally the water boils, the oil passes into steam, and mingles with the steam of the water, and then goes out through the tin pipe. As the steam passes through said tin pipe it becomes cooled by the water in the trough, it condenses into liquid, and out of the end of the pipe runs a mixture of oil and water. The oil is the oil of wintergreen, and, being heavier than the water, it drops into the bottom of the glass jar, while the water flows over and is saved in the barrel, to be again reboiled the next day. The oil is reddish in color, sweetish in taste, and has that peculiar and agreeable odor so well known and liked. The manufacturers dispose of it to the apothecaries for about two dollars a pound, who, after diluting it with alcohol, sell it to confectioners and others at the usual apothecaries' profits.

Thus, through the cold rains of spring and the heated term of summer labor the wintergreeners. In the chilly air of night they poke their furnace fire, listening the while to the dismal hootings of the owl. In the ashes they bake the potatoes for their frugal meal. Upon hemlock branches they sleep in their hut. Remote from the world and deprived of its luxuries, they must labor with diligence and patience through all the hours of day and night in order to earn as much as two dollars per man. But now cometh toward the camp an assistant internal revenue collector, who tells them that their tin pipe, cooled by the running water, is a worm or still, and that the law of this great nation forbids the use of such a condenser, except on the payment of an annual tax. And said tax of $35 he collects from them —$35 for each and every tin pipe used for the purpose of condensing said steam. And having made his collection he returns happy, leaving, however, the poor wintergreeners sad and solemn upon the mountain side, denouncing the rapaciousness of the Government.

Robert Briggs.

Robert Briggs, well known as a mechanical engineer and writer upon engineering subjects, died at Dedham, Mass., July 24. Until disabled by paralysis several months ago, Mr. Briggs has resided in Philadelphia. For a number of years he was superintendent of the Pascal Iron Works; afterward he filled the same office at the Southwark Foundry. Latterly he has been connected with the government works for the improvement of the navigation of Delaware River and Bay. Mr. Briggs was an active and prominent member of the Franklin Institute, and for a time was one of its managers. For about a year he edited the Franklin Institute Journal, besides contributing to numerous scientific publications. He was a thorough mechanic, and in his specialties of systems of ventilation, the erection of gas works, and the manufacture of gas, was an expert. He was about fifty-five years of age.

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Correspondence.

Many-storied Birds' Nests.

To the Editor of the Scientific American:

As some discussion arose, a short time since, in the columns of the SCIENTIFIC AMERICAN, relative to the many-storied nests of the summer yellowbird, it might be of interest to your readers to mention that during the present season a friend of mine found a nest of that species composed of *five* stories, each of which, except the top one, contained a cow-bird's egg. The fifth story was not quite completed when the nest was taken, but the egg of the intruder was already more than half buried in the new structure.

W. L. SCOTT,
Librarian, Ottawa Field Naturalists' Club.
Ottawa, July 24, 1882.

Auroral Phenomena.

To the Editor of the Scientific American:

Last night, August 4, a remarkable, and, to me, unusual appearance of the aurora borealis presented itself. About ten o'clock there appeared in the northwest a single streamer, running from the horizon toward the zenith. At first sight I pronounced it a comet. For a short time it did not seem to vary perceptibly either in position or brilliancy, but a slow motion westward was soon observed, the streamer meanwhile maintaining a position parallel to itself. When first seen it was nearly parallel to Chi and Psi Ursæ Majoris, and pointed directly to Eta of the same constellation. Its length was about twenty degrees, estimating from a bank of clouds eight or ten degrees above the horizon. As it moved westward it gradually lost its brilliancy, and at the time of its disappearance was pointing to Cor Caroli. With the exception of some light in the north-northeast, I could see no other evidences of the aurora.

On the 16th July last, at Lake Kampeska, near Watertown, D. T., a very beautiful but not unusual aurora was seen. The arch of cloud on the northern horizon was well defined, and was seen to great advantage in that prairie region, where the horizon is like that seen at sea. There was hardly any noticeable variation in the color of the streamers, and the only peculiarity which struck me as unusual was the rolling of the luminous undulation—if we may so call them—parallel with the beams and from east to west This wave-like appearance is often seen rolling upward from the horizon toward the vanishing point of the beams.

T. A. WYLIE.
Bloomington, Ind., August, 1882.

How to See the Attitudes of Animals in Motion.

To the Editor of the Scientific American:

While the attention of the public as well as of scientific men is being called in your valuable papers to the curiosities of the motions of running animals, it may interest many to know how easily we may test the accuracy of instantaneous photographs for ourselves. Like many others, I have been experimenting in photography, and I devised a kind of quick moving shutter, which I could operate with my fingers by moving a lever outside the tube. It occurred to me to look at animals in motion by merely putting the tube to my eye without any lens and operate the shutter. Immediately I had before me a series of instantaneous views without the costly appliances, and at will I could verify the strange attitudes set before us by the photographs of Muybridge.

One who has not tried it will be surprised and pleased at the perfection and instantaneous character of the sights he will get of a moving object. It takes but a very short "exposure" to make the picture on our eye complete. The moving object is caught and shown to us just as it happens for the instant to be. Any device for opening the field of view quickly will answer, and in this way artists and scientific men can study the curious attitudes which any animal presents, and may reconsider, as Muybridge and others are doing, the conventional methods of representing a moving animal.

Since making the above-mentioned observation I have noticed an account of the same by a writer in *Nature*, but I believe my experiment was first.

S. H. BRACKETT,
Teacher Natural Science.
St. Johnsbury, Vt., August, 1882.

Lake Superior Iron Mines.

The fact that most of the Lake Superior iron mining companies are close corporations which do not publish returns of their income, and do not seek the aid of the general public, fully explains how little is really known of their success as business ventures. It is understood, in a general way, that while the cost of mining and delivering to market is low, the prices realized are high, and it is inferred that the profits must be large. We have been able to gather a few figures, which may serve to afford a clearer insight into the operations of these companies, which nature and circumstances have wonderfully favored.

Last year, the output of the mines of the old Marquette and the new Menominee region together was 2,321,315 gross tons, valued at $18,834,923. It is estimated, by good authority, that, besides paying for a vast amount of prospecting work, and laying aside heavy surplus funds, these mines paid in all about eight millions of dollars in dividends. We may quote the following: The Republic, with a capital of 100,000 shares, at $25 each, paid $10 per share, and is now quoted at $65. In 1872, the stock was in vain offered at $12.50. The Lake Superior, having 60,000 shares of $25 each, returned to its owners $13 per share, and is now selling at $75. The Chapin earned probably as much as $30 per share, and declared $25 per share on 20,000 $25 shares. The Cleveland distributed a like amount. Six years ago, shares in the Champion mine were obtainable at $6. Now $150 is offered in vain, the dividends last year having been $30 for every one of the 20,000 shares. The Lake Superior, which was in debt to the extent of $1,500,000 at the close of the panic, paid from 1873 to 1877 $13.50 per share, besides wiping out its indebtedness and accumulating a surplus. The Menominee Mining Company, which started only a few years ago with 4,000 shares, having a par value of $25, earned $1,500,000, and sold four of its mines, the Norway, Vulcan, Quinnesec, and Cyclops, to the Cambria Iron Company for the sum of $1,800,000 cash, for the proceeds of the present year, and a further royalty of fifty cents per ton. It refused an offer of $3,000,000 for its principal mine, the Chapin. These figures would seem incredible were they not fully borne out by the data of cost and selling price of ore. The maximum cost of mining, delivered in cars, including general expenses and the cost of exploration work, is not more than $1.75, while it does go as low as twenty-five cents in some open-cut mines, where the cars can be run directly to the face of the cut. It is probably safe to say that the average cost does not much exceed $1 per ton. Most of the mines pay in addition a royalty of fifty cents per ton, and from sixty cents to $1.25 for rail freights to shipping points. The lake freights range from $1.10 to $1.35, so that the total average cost is, delivered at Cleveland, $3.75 to $4. Current quotations at Cleveland, which are, if anything, lower than the average, are, for Marquette ores, first-class hard Bessemer, $10 to $10.50; for second-class hard, $8.50; for first-class soft, $8.50; for second-class soft, $6.50; for high phosphorus hard, $6.25; and for high phosphorus soft, $5.25. For Menominee County ores, the following prices are obtained: For first-class Bessemer, $8.65; for high phosphorus hard, $6 to $6.25; and for high phosphorus, low grade, $5.25. Although the accepted limit for phosphorus in Bessemer ores is 0·1 per cent, buyers of Lake Superior ores rarely take them unless they run about one thousandth of one per cent for each per cent of metallic iron. Thus, a 60 per cent ore would not be taken if it ran higher than 0·060 per cent of phosphorus. It is impossible, in the absence of more than general information as to the relative quantities of the different grades of ores, to average the price realized. Taking it low, or at $7, it will be seen how handsome a profit the mining companies realize. Past experience, even in the dullest of times, has taught that, with the shipping, transportation, and marketing facilities then available, the mines producing the better grades have done well. With the enormous development of our Bessemer steel industry, particularly in the West, an outlet for this class of ores in much increased quantity is offered. It is not expected that the introduction of the basic process will impair the value of these mines, as for many years to come the new process has an enormous field in a direction not conflicting with the interests with which the Lake Superior iron mines are closely allied. Indeed, there are indications that a supply of suitable raw material might be obtained from the same region, and the occurrence of high phosphorus ores, running low in sulphur, and containing a small quantity of manganese, might prove of considerable advantage to smelters of basic pig.

During the last season prospecting has disclosed many promising mines, most of which are this year entering the list of producers. The old ones have, with the aid of the diamond drill, examined their ground thoroughly, and the great majority of them have ore in sight for many years to come. The managers of the mines are conspicuous for the energy with which they have adopted modern appliances, power drills, and high explosives, where needed, and long experience has taught them how to follow out the irregular deposits of some of the districts. The mines are, as a rule, in the hands of individuals and corporations whose business management is conservative, and who have persistently avoided appealing to the speculative public. The history of iron mining on Lake Superior, while it has its list of failures and reverses, has been singularly free from wild-cat schemes. The only deliberate swindle ever attempted turned out less disastrous to outsiders than those who concocted it themselves dreamed of, careful exploration having shown the presence of ore deposits where they were not suspected.—*Engineering and Mining Journal.*

Artificial Wood Ornaments.

Varied and partial success has, in the past, attended the production of embossed wood for furniture decoration and ornamentation. But wood, however thin, does not lend itself to the die as metals do, and the fiber on which its strength depends is more or less fractured in the operation. For this and other reasons it may not be superfluous for us to describe an entirely different process in use by B. Harrass, in Bochlen, in which an artificial wood is used.

The crude mass from which the articles are pressed consists chiefly of cellulose mixed with any sort of starch. The ordinary commercial cellulose, which is to be had in any quantity in the form of paper, is softened in water and thoroughly disintegrated. It is then put in a fine meshed sieve and the water drained off. It is then mixed with about 3 parts (by weight) of dry starch, made from wheat, rye, potatoes, Indian corn, etc., as well as 2 parts of rye or wheat flour, or corn meal, or any other flour that contains gluten, and very intimately mixed.

This mixture of cellulose, starch, and flour, is put in a suitable receptacle, pipes made of thin sheet metal are the best, and heated on a water bath for an hour. The tubes are then taken out and cooled to ordinary temperature. This cooking has converted the mass into a fibrous, tenaceous, glutinous substance, which is intimately mixed with an equal quantity of sawdust (or turnings). The stuff is then rolled out into sheets and dried in the air or in warm stoves, when they are ready to use.

The dies in which the mass is pressed are of iron, steel, or red brass, which are heated to 120° C. (248° Fahr.), and subjected to a pressure of 700 kilos per square centimeter (nearly 1,000 lb. per square inch). The stuff then becomes gummy, and fills out every corner of the mould fully. The article is at once removed from the mould while hot, and when cold very much resembles wood, being both hard and elastic, and in time gets as hard as bone. These articles can be worked and treated like wood; can be sawed, planed, and filed; dyed, polished, and glued.

Large articles can be veneered on the outside with natural veneer in this way. The mould is prepared and heated, and then from one to four strips of thin veneer, which have been previously coated on one side with glue or rosin and dried again, are put in the mould, according to its depth. This is covered with a layer of the dry and pulverized mass, from 2 to 20 millimeters thick, according to the depth. Thin and flat articles, like key-escutcheons, buttons, rilievos, etc., can be finished by once pressing, whereby the veneer becomes so firmly attached and united to the mass beneath, that it cannot be removed without destroying the article. In those having a high relief, and such as are hollow, the article is only partially formed by the first pressing, after which the press is opened again, and the reverse or cover, to which it almost always adheres, is taken off. If there are any spots not completely covered with veneer, a new strip is laid on after moistening the glue side. It is then covered with one large piece of dry veneer that covers the whole, and then put back in the press and the full pressure applied. On opening the press the article is taken out of the hot form finished.

To prevent the articles from drawing or warping after they are done, white pipe clay is added to the dry mass, and this also makes it more plastic, so it fits into the depressions better.

The artificial wood can also be directly veneered without using the pulverized material described, by placing the veneer that is glued on one side on the previously shaped or roughly pressed article, and then pressing it with the full force. Such articles are, however, more liable to warp.

To the pulverized and dried wood stuff there is added a small percentage of a binding material like dextrine, or albumen, or roasted and ground blood, and thus a strong connection is formed between the veneer and the pulverized wood mass, as well as between the latter and the artificial wood beneath. A good, dry, pulverulent mass for this purpose is obtained by mixing from 2 to 10 liters of pure cellulose (paper), with 6 to 30 liters of sawdust, 1 to 5 liters of dry dextrine in powder, or blood, albumen, rosin, etc., 1 to 5 liters of flour, and from ½ to 2 liters of pipeclay. To produce the color necessary for pressing it with the veneer, a small quantity of the dry color in fine powder is mixed with the powdered material.

Instead of pressing with the use of veneer as already described, *i. e.*, of putting the prepared veneer in the hot dye, then putting the dry cellulose on it in a powder, and then pressing it so that the real core of the article is of this mass, a saving of the latter is effected by using a large block of wood of proper shape, or by pressing in chips and small waste pieces of wood. This not only saves a good deal of material, but also gets rid of worthless bits of wood, and makes them valuable. For making very heavy articles, such as paper weights, pieces of metal could be pressed in as backing instead of blocks of wood.

A Cheap Ice Box.

With all the recent improvements in family refrigerators the price is still such as to be an item of considerable consequence to those of limited means. To dwellers in city houses, especially in "flats," the space they occupy is of more importance than their cost In some of these apartments they are supplied, built in the walls, while in others they are absent, so that the tenant who has none dislikes to buy, hoping that his next move will bring him one. In such a case the stationary wash tub is often brought into requisition for six days out of seven. To convert this into a refrigerator, plug not only the outlet but also the overflow, so that no sewer gas can enter. Then purchase a common japanned tin box such as are marked "bread" and sell for 50 or 75 cents. With a nail punch a few holes in the bottom, and put it in the stationary tub, letting it rest on blocks of kindling wood. In such a box 20 pounds of ice with the food for a family of five or six can be placed with ease. The ice does not melt faster than in a $10 ice box, and the water drains out into the tub as fast as it melts, and can be removed once a day by simply drawing the plug. Those who are using the device speak very highly of it, and it is not patented.

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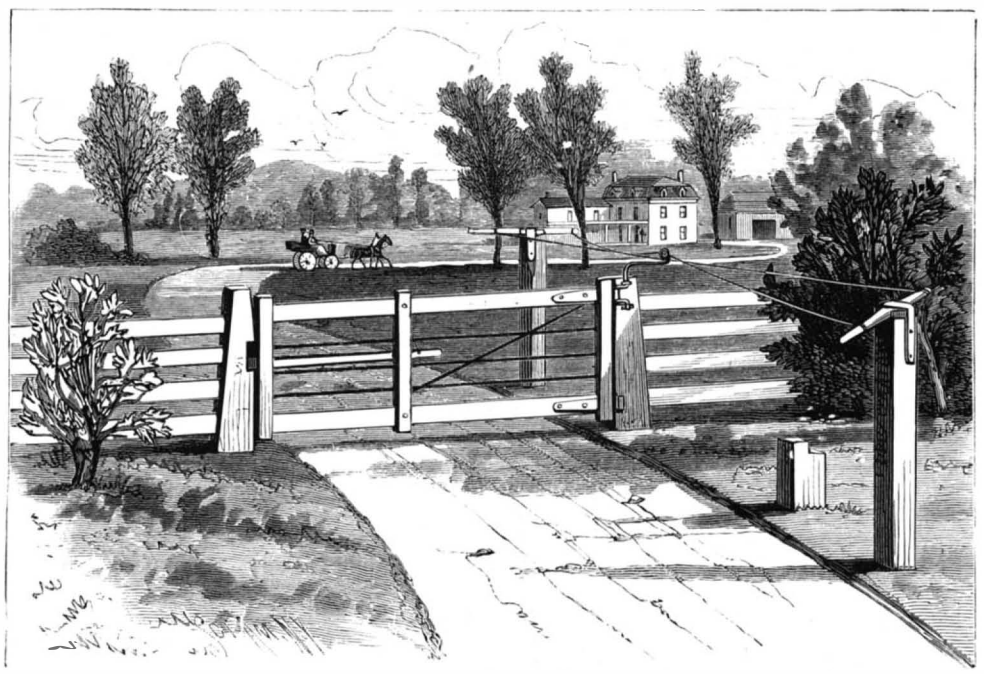
IMPROVED GATE.

We give an engraving of a new driveway gate, recently patented by Mr. John F. Lukens, of West Mansfield, O. The gate is composed partly of wood and partly of iron rods. It is very light both in weight and appearance, but amply strong. It is capable of being very easily operated from the carriage or by a person on horseback, and at the same time it may be opened and closed in the same manner as a common gate.

The gate opening and closing attachment may be readily applied to any of the ordinary gates now in use at a very slight expense. As shown in the engraving, the improvement consists simply of a crank formed of a wrought iron rod, and put through the upper eye of a common gate hinge. This crank is supported in bearings on the gate post, and the upper end of the rod of which it is formed is bent to form a lever for receiving the wires which connect with the levers, by means of which the gate is opened and closed. A movement of one of the hand levers in one direction turns the crank so as to raise the free end of the gate, when it will swing open of its own gravity. The movement of the lever in the opposite direction produces the reverse effect, and the gate closes.

Further information in regard to this invention may be obtained by addressing the inventor as above.



LUKENS' IMPROVED GATE

Ozone from Oxygen.

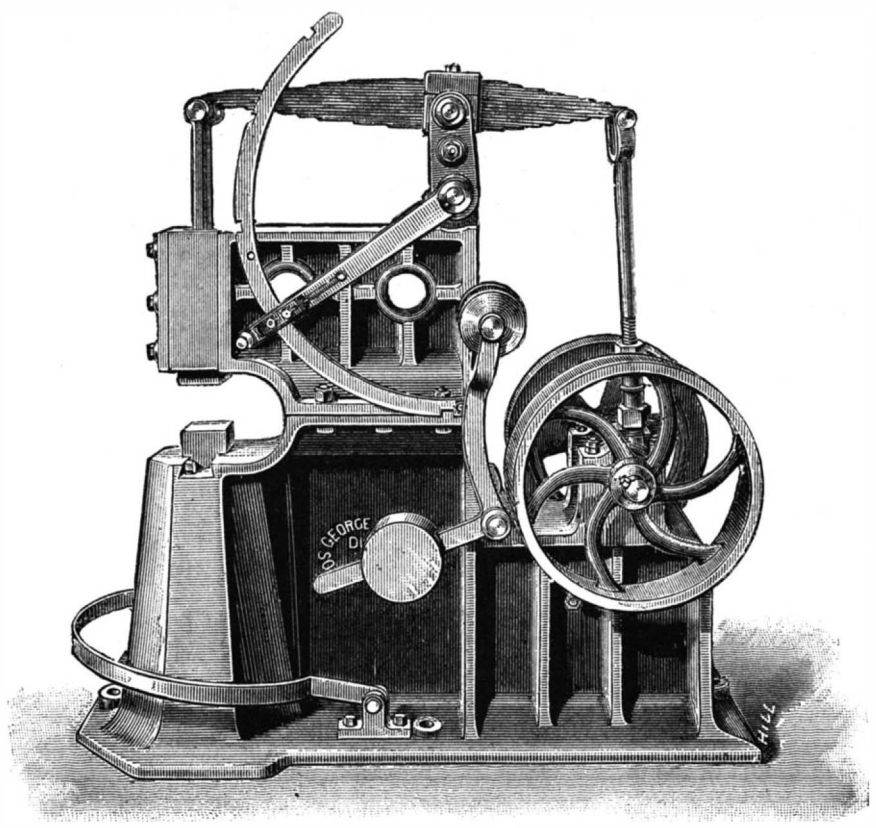
A French chemist, Dessan, has made a discovery in respect to the action of light that is likely to prove very important. He has found that oxygen may be converted into ozone by the action of light rays. In making his experiment, Dessan employed very pure oxygen; it was contained in a glass globe, which, together with the other apparatus, was carefully covered with black paper to prevent the admission of light. In these circumstances the oxygen did not betray the presence of ozone, but, after the rays from a Drummond oxyhydrogen lamp had shone upon the oxygen for twenty-five minutes, ozone was distinctly shown to be present on testing with iodide of starch.

SPRING STEAM HAMMERS.

The steam hammer shown in the accompanying cut is the invention of Messrs. George Booth & Co., and is particularly adapted to the rough shaping of iron work in machine shops, and is a useful substitute for the ordinary steam apparatus in the execution of general work of no very great importance. The driving pulley is connected with the shafting by means of a belt, so that the machine is always ready for starting. A gearing, actuated by a flat band of iron running round the base of the anvil, allows of the machine being instantaneously stopped at will. To effect the latter it is only necessary for the workman to cease pressing on this pedal, which is jointed at either side of the frame, and pulled by a spring that constantly tends to produce a stoppage.

Revolution is transmitted to an eccentric which is connected with a rod that actuates the spring. This latter is constructed like the bearing spring used on some vehicles. At its center it is set into a cap piece which is connected with a regulating mechanism. The latter consists of two lever arms, of which the larger moves over a notched sector. One of the notches is occupied by a catch tappet, whose position varies according to the nature of the work. The connecting rod likewise permits of a preliminary regulation. It is constructed in two parts, which are connected by one nut in common. The threads at the extremities run in opposite directions, so that the effective length of the rod may be varied in order to render the action of the hammer regular.

These ingenious arrangements permit of an exact determination of the force of the blow, from the neutral one up to the maximum impact. During the operation of the machine the hammer rebounds, and thus yields to the spring a certain live force that aids the eccentric to pass the dead center. The net weight of these hammers varies between 775 and 5,500 pounds. The smallest occupy a space of about 1½ by 3 feet, while the most powerful ones require a surface of about 4 by 6½ feet. The general form of the apparatus is elegant, and they possess all the solidity that machines of this kind should have.



SPRING STEAM HAMMER.

To size chromos or oil prints before varnishing, use a thin solution of fine glue, isinglass, or starch.

The Duration of Luminous Perception.

Attempts have repeatedly been made to determine the time which elapses between the appearance of a light before the eye, and the production of a signal by the person on perceiving the light. M. Charpentier has experimented afresh as to this, and with some novel results. The subject of experiment looked into a large blackened case and towards a window. A hole in the further side of the case was closed by a metallic shutter held in position by an electro-magnet, though not touched by it. A person behind the case broke the circuit of the magnet, so that the shutter fell; his act also produced a mark on a rotating cylinder. On seeing the light the person looking into the case pressed a spring with the forefinger of his right hand, and this act also, by electrical agency, produced a mark on the cylinder. The interval between these marks, compared with the *data* of an electric chronograph, afforded a measure of the so-called "duration of luminous perception." It appears that with the same person, and like conditions, this duration varies, without apparent regularity, to the extent of double. But a constant average may be arrived at from say a dozen observations; this, in the author's case, was thirteen hundredths of a second (direct vision). With different persons it varied from nine to fifteen hundredths. It is notably increased by other brain occupation—*e. g.*, speaking or attentive listening during the experiment. It is always greater in indirect than in direct vision, and greater the further the point of the retina struck from the center. This difference between the two kinds of vision is considerably reduced by many days' practice, but is never entirely suppressed. Practice also considerably shortens the duration of the reaction for different points of the retina. The exercise of an eccentric point affects the different points of the same retinal hemisphere, abridging the duration, but not those of the other hemisphere. Further, this shortening influence of exercise of a point in the inner half of the left retina extended to the outer half of the right retina, while the inner half of the latter retina reacted much more slowly than the same exercised part of the left eye.

An English Pleasure Yacht.

A Bell-Coleman refrigerating machine has just been fitted on board an iron screw steam yacht known as the Sea Queen, the owner of which, says *Engineering*, is Mr. James Galbraith, of Wemyss Bay, a gentleman who has long been prominently identified with the management of several well known lines of colonial steamers and sailing vessels. The yacht itself was built in the year 1880, by Mr. Robert Duncan, Port-Glasgow, and supplied with compound engines by Messrs. Rankin & Blackmore. Measuring 210 feet from figurehead to taffrail, by 25 feet in breadth, and 16 feet in depth (moulded); built under special survey of Lloyd's, and classed in Lloyd's Register; having a tonnage capacity of 565 tons, according to the Thames Y. M.; and provided with engines capable of indicating upward of 500 horse power in regular work—the Sea Queen is certainly one of the largest, most powerful, and handsomest pleasure yachts afloat. When handed over to the owner, her fittings, accommodation, navigating appliances, etc., were exceedingly complete; but Mr. Galbraith by and by came to see that, to make his magnificent yacht perfect, so that long voyages in warm climates, extending to days or even weeks on end, might be thoroughly enjoyed, the addition of a mechanical refrigerating machine was desirable. Placed in the after portion of the engine room, the refrigerator is supplied with steam from the main boiler, and is designed so that it can be worked with steam at 80 lb. pressure (which is that used for the ship's engines when at sea) or with steam down to 20 lb. pressure, as when the vessel is in port with the fires "banked." Roughly speaking, the machine occupies a space of about 54 cubic feet, the measurements being about 9 feet by 2 feet by 3 feet. The air compressor cylinder is 8 inches in diameter with 8 inch stroke. At the trial of the machine it was worked at from 60 to 220 revolutions per minute, and at 150 revolutions per minute it provided 3,000 cubic feet of dry air per hour, the temperature of which was considerably below zero. The meat chamber, which has been designedly kept small, has a capacity of 80 cubic feet, so that the machinery need only work part of each day. After the machine at the trial had been working only a few hours the temperature of the air in the meat chamber came down to 8° Fahr. It will thus be seen that the machine is capable of freezing water for table use and of refrigerating meat and other perishable provisions in such a manner that a supply quite sufficient for a three months' cruise may be taken on board before starting. Incidentally we may mention that this really very fine yacht is furnished with a steam launch, with steam steering gear by Bow & McLachlan, with steam capstan by Muir & Caldwell, steam gear for hoisting the mainsail, steam pipes to all the baths, steam heating apparatus in the pantry, etc. On trial her engines indicated 630 horse power, and her speed was 13 knots.

Ebonizing.

How to make woods, such as cherry, mahogany, etc., look like ebony, is often desirable, and a correspondent of the *Hub* gives the following directions:

To imitate black ebony, first wet the wood with a solution of logwood and copperas, boiled together, and laid on hot. For this purpose 2 ounces of logwood chips, with 1½ ounces of copperas, to a quart of water, will be required.

When the work has become dry, wet the surface again with a mixture of vinegar and steel filings. This mixture may be made by dissolving 2 ounces of steel filings in one-half pint of vinegar.

When the work has become dry again, sandpaper down until quite smooth. Then oil and fill in with powdered drop-black mixed in the filler.

Work to be ebonized should be smooth and free from holes, etc. The work may receive a light coat of quick-drying varnish, and then be rubbed with finely pulverized pumice stone and linseed oil until very smooth.

A SALT BED 115 FEET THICK.—There was completed, July 22, at Marine City, Michigan, a well which passed through 115 feet of solid crystal salt. Salt was encountered first at a depth of 1,633 feet, and from that point to the depth of 1,748 feet the material removed was pure salt.

THE universal square may be used as a try-square, T-square as a graduated rule, for laying out a miter, and for finding the center of a circle.

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COMPOUND NEST OF THE C. PALUSTRIS AND THE A. PHŒNICEUS.

BY DANIEL C. BEARD.

Almost every one whose business or occupation has introduced him to an intimate acquaintance with the salt marshes that line our eastern coasts, is familiar with the odd chattering notes of the marsh wren. This little bird finds its board and lodging among the reeds and rank grasses of the damp salt meadows. Morning and evening its song, if such vocal efforts can be so called, may be heard, but especially does it delight to sing at night. Often after a long sail, when belated and overtaken by night, the writer has welcomed the harsh, but not unpleasant, notes of the long-billed marsh wren (*Cistothorus palustris*) as a signal from shore and home.

Not long since a boating party caught in a dense fog only discovered their dangerous proximity to the shore from the warning notes of one of these little coastguard.

Other birds find refuge and sustenance among the salty sedges inhabited by the marsh wrens. Among them may be seen the brilliantly decorated *Agelaius phœniceus*, commonly known as the red wing or swamp blackbird. The lustrous black plumage of the male bird shines in the sun, giving out greenish metallic reflections. Its shoulders and lesser wing coverts are ornamented with crimson epaulets, giving it a very martial and rich appearance, in strong contrast with the modest brown plumage of its friend and neighbor the marsh wren.

Some time ago the writer published an article and illustration in this paper of a fish hawk's nest, the interstices of which were filled in with the nests of the cow blackbird (*Quiscalus purpureus*), making a sort of compound nest, or tenement house, of the structure. Following the above mentioned article was a second, illustrating and describing the strange two story nest the summer yellowbird builds to cover the eggs which that tramp, the cow blackbird, delights to surreptitiously deposit in the nests of smaller birds.

The same young collector that secured the writer the yellowbird's double nest, discovered and brought to him another two-story nest. This time both nests bore unmistakable evidence of being inhabited. The lower compartment, from its peculiar spherical form and the reeds and cat tail cotton of which it is composed, would be at once recognized as the nest of the marsh wren, even if it did not contain the little chocolate colored eggs of that bird. The upper nest is cup-shaped, three inches inside depth and diameter. The outside is made of coarse straw and fibers, and the inside lined with fine grass. A single glance suffices to prove it to be the nest of a swamp blackbird. Two bluish-green eggs, with strange hieroglyphic markings on the end, occupy the upper floor, and three little brown eggs are hidden in the lower nest. The blackbirds must have commenced the upper nest about as soon as the wrens finished the lower one.

In both the upper and lower stories of this seaside tenement house the eggs were warm when discovered, which proves that the mother birds had been off the nests but a few moments. The writer knows of no other recorded instance of a compound nest occupied by the red-winged blackbird and the little marsh wren.

The accompanying sketch, made from nature, shows the construction and difference in style of architecture of the nests, as well as the difference in the size and appearance of the birds themselves. It is a fact worth noting that in all three instances of compound nests the blackbird plays the part of a parasite in a greater or less degree.

COMPOUND NEST OF THE C. PALUSTRIS AND THE A. PHŒNICEUS.

The Preservation of Eggs.

Much scientific attention has been devoted in France to the preservation of eggs. The leading principle of all processes is the protection of the interior of the egg from the action of the atmosphere, and consequently it has long been settled that only the freshest eggs are eligible for preservation. To the solution of the problem of how to prevent the air from penetrating the shell of the egg, the experiments of such eminent *savants* as Musschenbroek, Réaumur, and Nollet have valuably contributed. They all agree that the most practicable method is to envelop the new-laid egg in a light coating of some impermeable substance, such as wax, tallow, oil, or a mixture of wax and olive oil, or of olive oil and tallow. Réaumur suggests an alcoholic solution of resin, or a thick solution of gelatine. Nollet experimented successfully with India-rubber, collodion, and various kinds of boot-varnish. In practice, the most successful method has been that of Cornier, of Mans. This consists in covering the eggs with a varnish, the composition of which is kept a secret. The eggs are packed on end in sawdust, and, it is said, will preserve their freshness during quite nine months in any climate. Cadet de Vaux suggested the plunging of eggs for twenty seconds in boiling water, in order to coagulate that portion of the albumen nearest the shell, and then to pack them in vessels half filled with sifted cinders. This process—which, by the bye, has been well known in some parts of Scotland for many years—yields excellent results, but if neglected for but a second or two, the eggs are liable to harden. The process known as "liming" in England, and as the Cadet-Gassicourt process in France, is very popular; on the other side of the Channel, however, "limed" eggs are never eaten *à la coque*, but only in the shape of omelettes, etc. Some preservers claim to obtain better results, as far as the taste of the egg is concerned, by substituting ordinary salt for lime. The solution, it is said, penetrates the shell, and so acts upon the organic matter as to diminish its susceptibility to decomposition. The eggs are immersed during several hours. Appert, the Columbus of food preservers, gave some attention to the subject of egg-preservation. His favorite process was to introduce the eggs into a bottle half filled with bread crumbs to prevent breakages. After carefully corking the bottle, he placed it for several minutes in a sand bath, the temperature of which he kept at 70°. For home consumption, the French peasantry have for ages preserved their eggs in a very simple fashion. They take a wooden case, or a large barrel, and pack them in thick layers of sawdust, fine sand, chalk, bran, cinders, or coal dust, so that they do not touch each other. In the Maritime Provinces, the peasants use layers of ashes moistened with salt water. Both these processes are successful. Drying eggs, and reducing them to powder (an invention patented by Chambard in 1852) is another method of preservation that is profitably pursued in France.—*London Grocer.*

The Suez Canal in 1882.

I was glad to see how much of the banks are now cased with stone. Trees grow with difficulty in the sand and their roots suffer from the salt water. A sandy bank is carried by the wash of the steamers into the deep water channel. But this stone casing resists the wash, and when it is complete the company will be able to increase without danger their regulation speed. We met with no obstacle for two hours. In this great highway of nations we saw no life save the wild marsh birds and the waste of water stretching away to the yellow desert. There are *gares* or passing places every few miles, where the deep waterway is widened from twenty-four to fifty yards, and sometimes more, and a signalman system stops or allows to pass the ships according as the run is free or occupied. We passed the first *gare* successfully, but at the second the ball was hoisted above the flag, which in canal language means "go into the siding." Nothing came by before sunset, when all traffic ceases, and we lay in the quiet moonlight with every intention to proceed at sunrise. But when I came up next morning to see the start I found a fleet of great ships, each with its noisy little tug and yellow flag at the masthead slipping along in single file. It was a grand way of realizing the work of the canal. Nineteen vessels went by, averaging, our captain told me, 1,500 tons burden. All save two carried the British flag. Three were crammed with pilgrims, forecastle, main-deck, and quarter-deck, one mass of life. Even the boats were full of them, and from under a canvas awning peeped the pale faces of women. One lot were Russion pilgrims from the Caucasus—savage looking fellows in fur caps and black cloaks; the others were Algerians and Moors in turban and burnous. The rest of the ships were cargo-laden, 22 and 23 feet in the water. All went by safely till the 17th, the Scotch Greys, came. She went a yard or two out of her course, and at once was aground. She had passed us, but others had still to come, and there was nothing for it but to wait till the Scotch Greys got free. Hawsers were made fast to stern and bow on either bank, and after an hour's shouting and steaming and winching, the big ship swung into place again. The rest came by without disaster, and we got under way ourselves at eleven o'clock.

The canal is not big enough for the present traffic. Shipping to the extent of over 3,000,000 tons passes through every year, and it is steadily on the increase. Ships have to wait their turn, and much valuable time is wasted at either end and in the passage. The accommodation may be increased in two ways. The whole length of the canal may be widened so as to allow of ships passing each other everywhere. Such a work would not be difficult, but it would be very costly. The deep-water passage would have to be more than doubled in width, as the slow speed makes steering difficult, and ships in passing would require plenty of sea room to avoid accidents. The present width of 25 yards would have to be raised to 60, but it would not be necessary to increase the width of surface of the whole waterway, which is already 100 yards from bank to bank. The second mode of increasing the facilities of passage is more feasible, and has much to recommend it. It consists in a considerable increase of the number of *gares* or passing places, and in the lengthening of those already in existence. There are at present thirteen, and they might easily be increased to twenty. The same precautions now practiced would be still enforced in the passing of ships. The block system would be carried out from *gare* to *gare*. The buoying of the passage is already excellent, and there would be no increase in the danger of fouling and jamming. The consequences of such accidents in so narrow a waterway as the canal are so serious that I think, on the whole, the increasing of the *gares* is most to be recommended. But one or other improvement is necessary.—*Correspondent London Times.*

An Eighty Pound Hailstone.

Considerable excitement was caused in our city last Tuesday evening by the announcement that a hailstone weighing eighty pounds had fallen six miles west of Salina, near the railroad track. An inquiry into the matter revealed the following facts: A party of railroad section men were at work Tuesday afternoon, several miles west of town, when the hailstorm came upon them. Mr. Martin Ellwood, the foreman of the party, relates that near where they were at work hailstones of the weight of four or five pounds were falling, and that returning toward Salina the stones increased in size, until his party discovered a huge mass of ice weighing, as near as he could judge, in the neighborhood of eighty pounds. At this place the party found the ground covered with hail as if a wintry storm had passed over the land. Besides securing the mammoth chunk of ice, Mr. Ellwood secured a hailstone something over a foot long, three or four inches in diameter, and shaped like a cigar. These "specimens" were placed upon a hand car and brought to Salina. Mr. W. J. Hagler, the North Santa Fé merchant, became the possessor of the larger piece, and saved it from dissolving by placing it in sawdust at his store. Crowds of people went down to see it Tuesday afternoon, and many were the theories concerning the mysterious visitor. At evening its dimensions were 29 x 16 x 2 inches.—*Salina (Kansas) Journal.*

Awards to American Electricians.

Among the awards to exhibitors at the International Electrical Exhibition at the Crystal Palace were the following: A diploma of honor to the Anglo-American Cable Company; a gold medal to T. A. Edison for lighting apparatus, etc.; a gold medal to the Anglo-American Brush Light Company for the Brush dynamo machine and arc lamp; a gold medal to the White House Mills, of Hoosac, N. Y., for a dynamo machine; a gold medal to the Direct United States Cable Company; a gold medal to Professor A. E. Dolbear, of Boston, for an electrostatic telephone; and a silver medal to the Philadelphia Dynamic Company.

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Etching Recipes.

BY MAJOR J. WATERHOUSE, B.SC., ASSISTANT SURVEYOR-GENERAL OF INDIA.

MORDANTS FOR ZINC.

The comparative cheapness of zinc would give it an advantage over copper or steel for engraving and etching with the graver or point, but it does not seem to be recommended for these purposes. It is hard to cut with the graver, and, though it bites easily, it is not suitable for fine work. Another defect is that it will not stand a long impression; but this may be overcome by surfacing the plate with copper. The principal uses of this metal for printing purposes are for surface printing or zincography, in the same manner as lithography, and for the process of biting in relief, and zincotypography or Gillotage, now so largely employed as a substitute for wood blocks. It can also be engraved very delicately in the same style as engraving is done on stone through a coating of gum.

The etching fluids for zinc are of two entirely different kinds: first, mixtures of gum and weak acids, used for preparing plates for zincographic printing in the lithographic press, or for the preliminary inking preparatory to being bitten in relief by the Gillotage process; and secondly, mineral acids, more or less dilute, used for biting in relief and ordinary etching.

Zincographic Etching.—This kind of etching is more a preparation of the plate for printing than engraving or biting, the object being merely to fill up the pores of the metal with gum, and prevent it receiving printer's ink from the roller elsewhere than on the lines of the drawing.

The solution most commonly employed for this purpose is the mixture of gum and decoction of galls, in use at the Ordnance Survey Office, Southampton, and given by Sir Henry James in his work on *Photozincography*. It is prepared as follows: 4 ounces of Aleppo galls are bruised and steeped in 3 quarts of cold water for twenty-four hours; the water and galls are then boiled up together, and the decoction strained. The gum-water should be about the consistency of cream. One quart of the decoction of galls is added to 3 quarts of the gum-water, and to the mixture is added about 3 ounces of phosphoric acid, which is prepared by placing sticks of phosphorus in a loosely-corked bottle of water, so that the ends of the sticks may be uncovered. The oxidation of the phosphorus produces phosphoric acid, which dissolves as fast as it is formed.

The etching solution should only just mark a piece of plain zinc.

In Richmond's "Grammar of Lithography" the following modifications of this formula are given:

Decoction of nutgalls	¾ pint.
Gum water as thick as cream	¼ "
Phosphoric acid solution	3 drachms.

Boil 1¼ ounces of bruised nutgalls in 1¼ pounds of water till reduced to one-third, strain, and add 2 drachms of nitric and 4 drops of acetic acid.

Richmond recommends, however, the use of simple decoction of galls without acid, and gumming-in after etching.

Knecht, in Roret's "Manuel de l'Imprimeur Lithographe," gives the following, containing copper, but this I find gives an unpleasant dark tone to the zinc:

Gallic acid	1 centigramme.
Water	1 liter.
Gum arabic	4 grammes.
Nitric acid	2 milligrammes.
Sulphate of copper	4 "
Sulphate of copper	50 parts.
Rock alum	40 "
Sulphuric acid	20 "
Gum arabic	60 "
Water	1,000 "

Husnik gives the following, also used by Hannot at the Depot de la Guerre, Brussels:

Gum arabic	40 parts.
Sulphate of copper	2 "
Gallic acid	5 "
Nitric acid	½ part.
Water	1,000 parts.

Motteroz uses gum-water acidulated with a few drops of muriatic acid, so that it will not visibly bite the plate—or better, decoction of nutgalls.

Moock gives:

Water	100 grammes.
Gum arabic	15 "
Nitric acid	2 drops.
or muriatic acid	4 to 5 "
Solution of nutgalls	10 grammes.

Scamoni has the following, by Garnier: Boil about 1¼ ounces of bruised gall-nuts in a pint of water, till reduced to one-third, filter, and add 2 drops of nitric acid and 3 to 4 drops of muriatic acid. For very fine work this may be weakened with water. It is applied for about a minute, then washed off, and the plate gummed.

Zincotypographic Etching.—In biting zinc plates in relief, the acid generally used is nitric, of different degrees of strength according to the nature and state of the work.

After the transfer is made, the plate is etched with one of the foregoing preparations, then inked-in and dusted with finely-powdered resin, which adheres only to the lines. This procedure is followed after every biting, the plate being warmed to melt the resin and inky coating, so that it may run down between the lines and protect them from the undercutting action of the acid.

Kruger, in his "Die Zinkogravure," recommends, for the first relief etching, nitric acid 30 to 40 drops to 100 grammes of water, applied for five minutes. For each subsequent etching 8 to 10 drops of acid are added for each 100 grammes of water, and the time is increased, by degrees, from five to fifteen minutes. For the final etching of the broad lights he uses:

Muriatic acid	4 parts.
Nitric acid	1 part.
Water	16 parts.

To soften down the ridges between the lines the plate is inked and dusted as before, and etched with dilute nitric acid at 5 per cent applied for about a minute, and the inking, dusting, and etching repeated as often as may be necessary.

According to Husnik, the first two bitings are given with 1 part of nitric acid to 40 of water, the first biting lasting two minutes, the second four to five minutes. For the third biting the acid is used double the strength, and applied for five minutes. The acid is made stronger for each successive biting.

Moock ("Impression Photographique aux Encres Grasses") gives a first biting with nitric acid at 2 per cent for two or three minutes, adding about the same quantity of acid for five successive bitings, gradually increasing the time. After the first five bitings, the plate is thoroughly cleaned, strongly heated, well inked again with a harder ink, and rebitten with acid as strong as the last used; the operation is repeated for four more bitings, using less heat, and biting less and less each time. These last bitings are for smoothing off the edges of the lines.

In his "Instruction in Photography," Captain Abney gives the following process:

Having made the transfer in the usual way, and dusted it with resin, flood the surface of the zinc plate with a 10-grain solution of sulphate of copper, which precipitates copper on the uncovered parts, and forms a copper-zinc couple. It can then be etched with very dilute acid.

Hydrochloric acid	1 part.
Water	500 to 750 parts.

This is contained in a rocking trough kept constantly in motion. The first etching takes about twenty minutes. The plate is then washed and inked, dusted and coppered again, and then etched with acid twice as strong, the operation being repeated as often as may be necessary.

The following method is somewhat similar, though, in this case, the acid bites the parts not covered by the copper.

A zinc plate, covered with varnish, and etched with a point, is treated with a neutral solution of copper, which deposits copper on the lines. The varnish is then removed, and the plate etched with muriatic acid, which bites the zinc, leaving the copper untouched. As soon as a perceptible relief is obtained, the plate should be inked and bitten in the ordinary way.

A very excellent method of biting zinc in relief is by galvanism. Roret's Manual—before quoted—gives two methods by Dumont and Devinceuzi.

In Dumont's Method the plate, having been inked in, and dusted with resin, has a copper conducting wire attached to it, and is then placed in a wooden frame parallel to a copper plate of the same size, at a distance of about twelve inches, and the whole is plunged into a bath of sulphate of zinc. The zinc plate is connected with the carbon pole of a Bunsen battery, and the copper plate to the zinc pole. A weak current is allowed to act, and the sufficiently-bitten parts are stopped out from time to time.

M. Devinceuzi's process is similar to the above, and, from trial, I know works very well.

The plate, having been rolled up with a strongly-resinous ink, is slightly etched with very dilute sulphuric acid, to clean the surface, and is then plunged into a solution of sulphate of copper at 15° Baumé (about 70 grains to the ounce), in connection with a plate of copper of the same size, placed about one fifth of an inch away from it. The plate is taken out every minute or so, to remove the copper, and at the end of from four to five minutes is sufficiently bitten to yield good impressions from a chalk original. A drawing with a pen may require seven to ten minutes.

Before leaving this part of the subject, it may be mentioned that, in the processes for biting with nitric acid, it is essential to keep the acid in constant motion, and in some establishments the strength of the acid is maintained during the biting by allowing nitric acid to fall drop by drop from a bottle or other vessel placed above the trough.

Deep Etching.—For simple etching on zinc, Seymour Haden recommends 1 part nitric acid to 3 of water; or,

Hydrochloric acid	10 parts.
Chlorate of potash	2 "
Water	88 "

Dissolve the chlorate of potash in half the water—boiling—and mix the hydrochloric acid with the remainder. The two solutions are added together for use.

Kochler ("Lalanne's Etching") says 1 part of nitric acid to 8 parts of water is equal in effect to equal parts of acid and water used with copper for the same length of time.

A. Martin uses 1 part nitric acid to 2 of water.

Kruger ("Die Zinkogravure") gives:

Sulphate of copper	2 parts.
Chloride of copper	3 "
Water	64 "
Muriatic acid	8 "

also

Nitric acid	1 part.
Water	40 parts.

M. Gourdon has proposed a curious process of photo-engraving on zinc, founded on M. Merget's discovery that if zinc be covered by precipitation with certain metals, it is only bitten by nitric acid in the parts left uncovered, while, on the contrary, dilute sulphuric, muriatic, acetic, and other acids will bite it only in the parts covered by the other metal. Thus if zinc is covered in parts, as by writing, with a thin coat of powdery platinum, the parts covered with the platinum may be etched with sulphuric acid diluted with 7,000 parts of water. If gold be substituted for platinum, sulphuric acid diluted with 5,000 parts water will etch it. Silver requires 3,500 parts water; tin, 1,500; antimony, 700; bismuth, 500; lead, 400.

M. Gourdon takes an ordinary silver print, fixed, but not toned, and well washed, and transfers it, face downward, on a plate of zinc. It is moistened on the back, first with ammonia, and then with a solution of cyanide of potassium, pure, or mixed with carbonate of soda. After a while the silver image will be regularly transferred to the zinc, and can be etched with very dilute sulphuric acid to form an engraved plate.

Boivin plates a zinc plate with silver, treats it in the dark-room with an alcoholic solution of iodine, washes it, and passes over it a solution of tannin or pyrogallic acid, and dries.

The plate is exposed to light for a few minutes under a cliché, and then plunged in the dark into an electro gilding bath attached to the negative pole of the battery.

Those parts of the plate where the light has acted on the iodide will take a coating of gold, while the other parts will refuse it. The iodide of silver is dissolved with cyanide of potassium, and the plate is then bitten, the gold parts forming a reserve.

Moock etches zinc with one or two Daniell cells, the plate to be etched being in a separate trough containing dilute nitric acid at 3° B., and attached to the copper pole of the battery, while the conducting wire from the other pole dips about an inch into the acid. The etching takes an hour or two, according to the subject, and, if necessary, parts can be stopped out when sufficiently bitten.

According to Scamoni, sulphuric, nitric, muriatic, and pyroligneous acids all etch zinc, but must be well diluted with 20 to 30 parts of water.

Mordants for Brass and Bronze.—Neither brass nor bronze seems to be much used for book-work engraving. According to Kruger, the mordants for brass are much the same as for copper.

For surface printing on brass in the lithographic manner, Roret's Manual gives:

Gum arabic	8 parts.
Nutgalls	2 "
Nitric acid	1 part.
Phosphoric acid	4 parts.
Water	80 "

For etching bronze, the following is given in Roret's "Manuel du Graveur:"

Pure nitric acid at 40°	100 parts.
Muriatic acid at 20°	5 "

—*Photo News.*

Accident in a Grain Elevator.

The large elevator, A, of the New York Central Railway, at the foot of West 65th street, was seriously imperiled August 1, by the breaking of a shaft on the top floor. The elevator is 350 feet long, and 145 feet high. It is operated by two powerful engines in the basement, the power being transmitted by a rubber belt (300 feet long and weighing 3 tons), which connects the driving wheel of the engine with a shafting wheel on the top floor. The shafting wheel weighs 4 tons, and connects with a horizontal steel shaft, 7 inches in diameter, running the whole length of the building. This shaft broke close to the wheel, which was thrown out of place with great violence. The shaft was bent and twisted. The friction of the displaced belt against the sides of the openings in the floors caused a burst of flame at each point of contact, but fortunately the belt slipped from the wheel, and its furious motion was stopped before the flames got beyond control.

Cotton Stems for Cattle Food.

Mr. Edward Atkinson has found a new element of value in the cotton crop, and one which promises to materially advance the prosperity of Southern farmers. It appears that for each bale of lint there are 1,500 pounds of stems, which are very rich in phosphates of lime and potash. When ground and mixed with ensilage or cotton seed meal (which is too rich for use as fodder in large quantities), the stem mixture makes a superior cattle food, rich in all the elements needed for the production of milk, meat, and bone. It is believed that this utilization of the cotton stems, hitherto a nuisance, will prove to cotton growers a new source of wealth, and in many parts greatly facilitate the raising of stock, by furnishing a substitute for grain, which now has to be brought from the West for stock feeding.

THE FOUR GREAT PORTS.—Liverpool ranks as the most important port in the world, with an annual tonnage of 2,647,572; London stands second, with a tonnage of 2,330,688; Glasgow third, with 1,432,364; New York fourth, with a tonnage of 1,153,676. As a manufacturing city New York leads the world.

BENZINE will answer much better to exterminate roaches, moths, etc., than anything else. It will not hurt furniture in the least, and can be easily applied.

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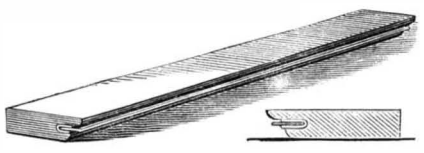
RECENT INVENTIONS.

Reclining Chair.

A chair hammock, which is easily and readily adjusted for a sitting, reclining, or recumbent posture of the body, has been patented by Mr. Alden Graham, of Boston Highlands, Mass., and is shown in the accompanying engraving. The base of the chair is of ordinary construction, and has upper side rails that are secured at their upper ends to the front portions of the frame, and are attached to the frame at the rear portion so as to slant down and back, and have notches on their upper edge. The sides of the base have secured to their rear inner surfaces fixed cams, against which the side pieces of the chair back rest. The side pieces, C, of the back are united by rounds, and have the side pieces of the base of the chair pivoted to them on opposite sides. To the side pieces, C, and to the front pieces arms are pivoted and the front pieces turn on the upper front round of the base. The back of the chair is made of canvas, attached at its opposite ends to the upper round of the side piece, C, and the lower round of the side piece, G. The round of the side piece C, has a ratchet and pawl by which the tension of the cover may be regulated. Braces are pivoted to the pieces, G, that engage with the notches in the upper rail of the base, when the chair is in an upright position, and retain it in this position. When the occupant of the chair desires to change his position he raises the braces out of the notches and throws himself backward, and the side pieces, C, resting on the cams balance the chair and body so that they may be adjusted to different positions, the cams forming a constant and firm support.

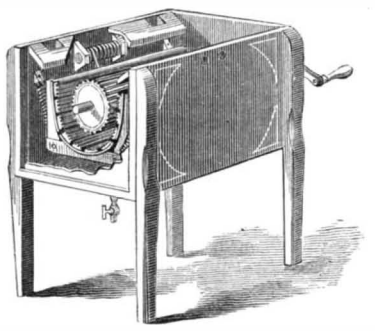
Improved Ruler.

Mr. George L. Knox, Secretary of Colwell Lead Company, 63 Centre street, New York, has recently patented a ruler by which the ink that may pass from the pen to the ruler is absorbed and effectually prevented from running down upon the paper to be ruled. This is an ordinary ruler having in one of its edges a deep groove extending its entire length, and in this groove is placed a folded plate of sheet metal. In the recess of the folded metal plate a strip of blotting paper or other absorbing material is placed, the outer edge of which reaches to near the outer edge of the ruler, as shown in the annexed engraving. The metal of the folded plate has some elasticity, so that when removed from the groove the sides will open slightly to receive the absorbing strip and when placed in the groove it acts as a spring against the walls for holding itself securely in place. The metal plate may be removed at pleasure for renewing the absorbing strip and for adjusting its edge at a proper distance from the edge of the ruler.



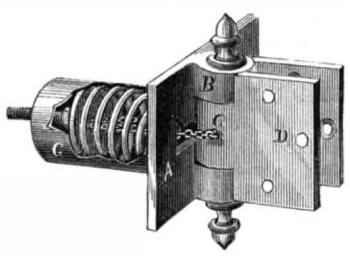
Washing Machine.

Mr. George C. Miller, of Alliance, O., has recently patented improvements in washing machines, by which the clothes may be thoroughly washed without injury. The wash box is of the ordinary construction. Two horizontal bars, to the ends of which are hinged the ends of uprights, are suspended from the sides of the wash box by spiral springs, as shown in the engraving. On the upper side of the horizontal bars is secured a rub-board, the upper side of which is concave and corrugated, and to each pair of the upright bars is also secured a rub-board corrugated on its inner side. Coiled springs are properly secured between the rub-board and the sides of the box, that press the boards toward the center of the box. Within the space between the rub-boards is placed a corrugated cylinder, which is journaled in bearings attached to the box, and to one of the journals is attached the crank by which the machine is operated. The clothes to be washed are placed in the space between the cylinder and the rub-boards, and the cylinder is revolved. The springs attached to the horizontal bars, and placed behind the rub-boards, allow the boards to adjust themselves to the thickness of the clothes passing through the machine.



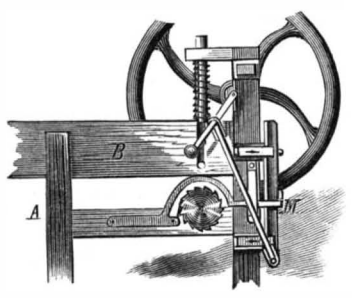
Spring Hinge.

The spring hinge for automatically closing gates or doors from either direction, shown in the accompanying engraving, has recently been patented by Mr. Ezra Ale, of Altoona, Pa. A hinge plate, A, having two jaws, B, projecting from its flat surface, is secured to the frame of the door, and between the jaws, B, is inserted a loop, C, attached to the edge of a socket hinge plate, D, that receives and is secured to the edge of the door or gate, and by passing a pintle through the jaws and loop a hinge is formed. A tubular casing, G, projects from the back of the plate, A, and at the inner end of the casing the plate has a transverse aperture. A cross piece in the casing, G, rests on one end of a spiral spring, the opposite end of the spring resting against the plate, A. A screw rod passes through the cross piece, and to its inner end two chains are attached, their opposite ends passing through the aperture of the plate, A, and are attached to the opposite sides of the hinge loop, C. When the door is swung in either direction the spring is compressed, and if the door is released the spring closes it, and if the hinge is applied on a door swinging in one direction only but one chain will be required.



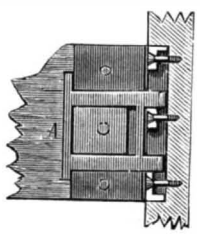
Straw Cutter.

A new and improved straw cutter, patented by Mr. John W. Baughman, of Wooster, O., is shown in the accompanying engraving. A is the frame of the machine, and B is the feed box. The front posts of the frame rise above the top of the feed box, and to their upper parts are attached bearings in which a shaft revolves. To one end of the shaft is attached a large balance wheel, and the other end is a crank, by which the machine is turned. Upon the middle of the arm of the crank is formed a second crank, and to the spoke of the balance wheel, at the same distance from the axis of the shaft is attached a crank pin. The crank and the crank pin are connected to the lower corners of the knife frame by two connecting rods, and the knife frame is kept in place by slides and gibs placed on the forward end of the frame, which slides up and down carrying a knife attached to it in an inclined position. To the side bars of the knife frame are attached lugs, which, as the frame moves upward, strike against and raise the projecting ends of the levers, M, the levers being pivoted to pawls that engage with ratchet wheels attached to the ends of the upper and lower feed rollers. The levers, M, are kept in place, and are made to operate in vertical planes by keepers attached to the opposite sides of the machine through which the levers pass. To the forward side of the frame, A, is attached a steel plate in such a position that the straw, while being cut, will rest upon the upper edge of the plate, which thus serves as a stationary knife.



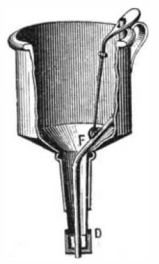
An Improved Bedstead Hook.

Mr. Jackson J. Kenneday, of Cleveland, Bradley county, Tenn., has patented a new and improved bed hook for holding the side rails firmly to bedstead posts, which is shown in the annexed cut. A metal frame, A, provided at one end with one or more projecting hooks, and at the opposite end with a flange, is placed against the inner surface of the bedstead rail at the end, in such a manner that the flange will project from its inner surface. The metal frame is held to the rail by a block fastened by screws to the inner surface of the rail, and having transverse grooves on its inner surface for securing the bars of the frame, A. The block extends from the flange to near the inner ends of the hooks, and at the outer end has a recess uniting the two grooves which receive the bars. The bed post has a vertical recess for receiving a socket plate in which are slots for receiving the hooks of the plate, A. If the hooks are passed into the slots, the bed rails will be held to the posts. The device is strong, simple, and durable, and very effective.



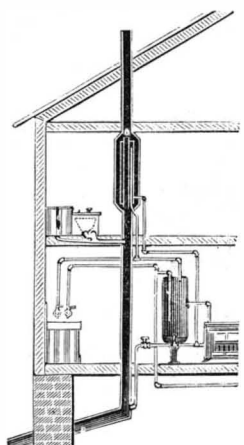
Improvement in Funnels.

A funnel that is so constructed that the flow of the liquid from it can be interrupted at any time, preventing loss and waste in filling bottles and casks, has been patented by Mr. Oscar T. Petzold, of Sebnitz, Saxony, Germany. A suitable shaped vessel for a funnel is provided with a slightly tapering neck which is surrounded with a sleeve of rubber that extends almost to the bottom of the neck, as shown in the engraving, the rubber sleeve causing the neck to fit well in a bottle neck. A cap, D, having large side apertures, fits closely on the lower uncovered end of the neck, and is attached to a tube, F, that passes through the bottom of the cap through the neck and extends up to the upper edge of the vessel. The cap, D, is provided with a packing strip resting against the lower end of the funnel neck when the cap is raised. The upper part of the tube, F, passes through a slot in a lever pivoted to the upper edge of the vessel, directly above its handle, so that the lever can be operated by the thumb of the hand holding the funnel. If the parts are in the position shown, the liquid can flow from the vessel through its neck and the apertures of the cap. If the outer end of the lever at the top of the vessel is depressed, the tube, F, will be raised and the packing strip pressed against the lower end of the neck, closing it, stopping the flow of the liquid. During the operation of filling the air passes off through the tube, F.



Ventilating Soil Pipes.

The invention shown in the accompanying cut is for carrying off the foul gases from soil pipes of dwellings. As these gases are a fruitful source of disease, and death in many instances, an invention providing for their sure removal cannot but prove valuable. This invention has been patented by Mr. John D. Harrington, of Auburn, N. Y. The soil pipe has an enlargement containing a cylindrical vessel closed at its top and bottom, and a tube open at its ends extends longitudinally through the vessel. A hot water pipe from the heater of the range passes through the bottom of the vessel to near its top, and an outlet pipe runs from the bottom of the vessel to the water back of the range. In operation the hot water passes from the heater through the hot water pipe into the vessel, heating it and the tube, which in turn heat the air in the soil pipe, causing a draught which carries off all the foul gases through the pipe and out at the roof. As the water cools it sinks to the bottom of the vessel and is carried back to the heater, and in this manner a continual circulation is maintained in the vessel, and consequently continual draught through the soil pipe is secured.



Indians as Workmen.

The popular theory that the Indian cannot be made to work is not altogether unfounded. It by no means follows, however, that he cannot be induced to work, and work well, when removed from his native surroundings and supplied with the proper incentives. The Indians in the industrial schools at Hampton, Va., and at Carlisle, Pa., have shown a readiness to acquire trades and a capacity to learn to handle tools skillfully that must stagger the prejudices of those who have adopted the frontier creed that the only useful Indian is a dead Indian.

At the recent public exercises at Carlisle, a Plains Indian was the proud, though seemingly stolid, exhibitor of a wagon built entirely by himself, a piece of work that older mechanics might not have been ashamed of. The Springfield *Republican* says that there are now on exhibition in Boston samples of shoes and harnesses made at Hampton Institute, which both in finish and serviceableness are able, in the opinion of competent inspectors, to compete successfully with the products of regular workmen. The shoes are part of a contract for two thousand pairs which the Government gave to the Superintendent of the Institute, General Armstrong, last spring. The Government has also ordered seventy-five sets of double-plow harnesses.

General Armstrong is confident that within five years, as the hundred Indians at Hampton, the three hundred at Carlisle, and others under instruction elsewhere, become masters of the craft, all the shoes and harnesses needed no the plains can be made by Indian young men at home.

Cotton Seed in Spasmodic Croup.

George L. Gray, M.D. (*Miss. Val. Med. Monthly*), claims that cotton seed is an efficient remedy in spasmodic croup. A handful of seeds is bruised and afterward boiled for a few minutes in a quart of water. The decoction is allowed to stand for a short time, when it is strained, sweetened, and cooled. The patient should now be given all it will drink of the medicine, or if necessary, it may be poured down the child's throat. Relief is generally prompt, and sometimes without vomiting. If, however, the remedy be persistently given it will produce free emesis.

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ENGINEERING INVENTIONS.

A self-acting car coupling, which is adapted to be attached to and used with the ordinary link and pin drawheads, has been patented by Mr. Joseph D. Wilson, of Kansas City, Mo. The coupling consists principally of collars attached to the drawheads by pins which pass through them and the ordinary pin holes in the drawheads. The collars are provided with suitable locking devices, and are so constructed as to be partially rotated upon the drawheads by means of pivoted weighted levers. The rotary movement of the collars on the drawheads serves to operate the locking devices, to couple or uncouple the cars, as may be desired. The weighted levers may be operated from the top or sides of car as desired.

An improved automatic car coupling has been patented by Mr. Charles E. McCarthy, of Forsyth, Ga. In a vertical recess, back of the throat of the drawhead, is a trigger bar pivoted at its lower end, and its upper is formed into a catch and extends through a slot in the drawhead back of the pin hole. A tubular projection above the pin hole sustains a short headless pin, and a latch that is pivoted in a slot in the rear wall of the projection projects across the pin hole and forms a support for the pin, when it is elevated, while the other end passes under the catch of the vertical trigger bar. The pin being sustained on the latch, whenever the link enters the drawhead, it pushes back the trigger bar, and the weight of the pin tips the latch, allowing it to drop through the link and couple the cars.

The object of an invention recently patented by Mr. John W. Crump, of West Point, Miss., is to increase the strength and durability of levees. The usual muck ditches are made along the line the levee is to occupy, and piles are driven along the back edges of the ditches. To these piles are secured horizontal boards, forming continuous fences, each fence being of less height than the one in its rear. The outer fence is at the crown of the levee, the adjacent fences diminishing toward the river front. The dirt is then thrown over the fences, and the levee formed in the usual manner. To the upper ends of the piles are pivoted arms to be swung up and held in a vertical position. In case of danger of a crevasse the arms are raised and serve as supports for planks for preventing the washing of the crown of the levee.

A novel automatic car coupling has been patented by Mr. William T. Van Dorn, of Lincoln, Neb. The drawhead of the car has the usual flaring mouth, and also has an opening on one side in which a retaining device for the coupling bar is arranged. The bar is pointed at one end, and has at this end a lateral catch having a straight bearing for the coupling pin. The pin presents an inclined surface to the front end of the bar, while its bearing surface corresponds with the bearing surface of the catch. When the end of the bar strikes the pin it is deflected against a retaining spring placed above the pin, the spring yielding sufficiently to allow the catch to pass behind the pin. The opposite end of the bar is perforated to receive the ordinary coupling pin.

MECHANICAL INVENTIONS.

Improvements in devices for lasting the shanks of boots and shoes have been patented by Mr. Frank Beyerle, of North Branch, N. Y. The device consists of two clamps, each composed of a fixed and movable jaw pivoted to each other, their grasping ends being serrated, and the lower ends of the movable jaws being moved by means of a screw to close the jaws at their grasping ends. The fixed arms extend beyond the pivots and pass through apertures in a sliding plate, and at their lower ends grasp a nut through which a screw passes, which, when it is turned, rests against the sliding plate and presses it to move the grasping ends of the jaws toward each other, and stretch the shank tightly over the last.

A fifth wheel for vehicles, so constructed that it will not be liable to break or get out of place when exposed to a side strain, has been patented by Mr. George W. Smith, of Darlington, Wis. To the under side of the head block a plate is secured, and upon the lower side of the center of the plate is a projection, which is concaved upon its under side, to receive a convex projection formed on the upper side of a lower center plate secured to the axle. The king bolt passes through the centers of the two plates and the head block and holds them together. The sides of the lower circle of the fifth wheel are vertical and its top is oval, and this circle fits into a correspondingly shaped upper circle, the two circles being held firmly to their parts by clips and bolts. With this construction all breakage from side strain is prevented.

Mr. John D. Underhill, of Hoboken, N. J., and Elizabeth Underhill, of New Rochelle, N. Y., have patented devices for equalizing the driving power of a coiled spring, to adapt it to drive sewing machines at a uniform speed. A regulating wheel, driven by the coiled spring, has a spiral row of perforations on its face from near its center to its periphery. A spur wheel, whose teeth engage with the spiral perforations, slides upon a feather upon its shaft, and the outer end of the shaft is provided with a gear wheel which engages with a train of wheels, through which the power is applied to the machine to be driven, with a gradually increasing leverage as the force of the uncoiling spring decreases.

A windmill that automatically regulates itself has been patented by Mr. Benjamin J. Bragdon, of Beloit, Kan. The main shaft of the mill is pivoted vertically between adjustable bearings, and has fixed collars at each end that carry three or more radial arms that have at their outer ends curved side arms. The vanes are regularly curved in cross section, and are hinged at their centers to the ends of the radial arms, and the curved side arms act as stops to the windward sides of the vanes. The windward edge of one vane is connected by rods to the leeward edge of the opposite vane. Governors are suspended from the upper collar by rods that pass through eyes attached to the leeward edges of the vanes, and by their weight and the centrifugal force obtained by the revolution of the mill automatically open and close the windward edges of the vanes, and regulate the amount of wind admitted.

Mr. Alfred Marland, of Pittsburg, Pa., has patented improvements in that class of nut machines which cut the blanks from a bar or rod and compress them in a suitable forming die, and at the same time punch the blanks in the line of the length of the bar from which they are cut, and then automatically discharge them from the die. The machine consists of a forming die, two crossheads carrying hollow compressing mandrels through which the punches move, and a crosshead carrying the main punch and the cutting bar, all of which are operated through connecting rods, yokes, and levers from cams on a single main driving shaft. By this machine the nuts are more perfectly formed, and the machine is more efficient for its purpose than those before in use.

ELECTRICAL INVENTION.

Mr. Charles A. Cooley, of New Britain, Conn., has patented a commutator constructed so that the wearing segments may be quickly renewed without disturbance of the armature wires or the removal of the commutator from its shaft. The armature shaft is made tubular to receive the wires from the armatures, and on this shaft are flanged metal hubs having at each side vulcanite washers for insulating the hubs. Rods extending through the flanged hubs and the washers are enlarged between the two hubs, and are insulated by sleeves of vulcanite. To these rods segments of copper are secured by screws to form the wearing surfaces of the commutator. The copper segments are of suitable thickness to sustain the wear of the commutator brushes for a reasonable length of time, and can be easily removed by taking out the screws and new segments put in place.

AGRICULTURAL INVENTIONS.

An invention for removing the leaves from sugar cane stalks has been recently patented by Mr. William P. Gard, of Parsons, Kan. A frame has in its forward side a rectangular recess, in which are placed four triangular plates forming a square. Each triangular plate is held forward by a spring, and the plates and springs are secured in place in the recess by a frame secured to the face of the main frame, that is so cut away as to have the middle part of the plates uncovered. The adjacent angles of the plates are notched, forming a hole which flares toward the rear side of the plates. The stripper is placed in front of the rollers of a cane crusher, and the smaller ends of the stalks passed through the hole are grasped by the crushing rollers and drawn through the stripper into the mill.

An improved wheel cultivator has been patented by Mr. Alfred Messersmith, of Munster, Ill. The beam of the cultivator is secured in the usual manner to the axle of the wheels. The arms which carry the cultivator teeth are secured together at their front ends, and extend rearward and are bent to hold the teeth in a proper position in relation to each other. At their rear ends they are bent downward and are provided with a series of holes to receive hooks for securing the teeth to the arms. The cultivator tooth is of the usual construction, and is provided with a round shank around which the hooks pass and by which the teeth are held firmly to the bars. Suitable handles are provided for controlling the cultivator.

Mr. Stephen C. Smith, of Poole's Mill, Ky., has patented a device for pulling sprouts. To the plane surface of a segmental block having parallel sides is hinged a lever, which from its hinged point forward is beveled on its under side, and on its upper side has a notched metallic plate. The lower end of an arm, having at its upper end a right angle jaw, is secured to the side of the block. In use the lever is raised to a vertical position, and the sprout is placed between the angle jaw and the notched plate on top of the lever, the segment block resting on the ground. When the lever is depressed the sprout is pulled from the ground.

MISCELLANEOUS INVENTIONS.

An improvement in shovels has been patented by Mr. Robert T. Pettibone, of Wyoming, Pa. In the usual construction the back strap projects from the surface of the blade and obstructs the use of the shovel, besides wearing the strap and rivets, or else when the back strap has been countersunk in a recess, the ridge on the face of the blade is open to the same objection. In this invention the back strap is shaped to fit the sides of the socket formed in the blade for the handle, so that the middle part of the strap forms the back of the socket, while the edges are bent backward, as straight flanges, which, being riveted to the sides of the handle socket, leaves the back strap flush, or nearly so, with the blade.

A device for cleaning fur robes rapidly and at little expense has been patented by Mr. Ferdinand Hosch, of Brooklyn, N. Y. The robe to be cleaned is secured to a large drum that rotates about forty times in a minute. A beater in the bottom of a box placed above the large drum rotates, in the same direction as the drum, about three hundred times in a minute and brushes against the robe. The box is filled with sand and sawdust, which is rubbed into the fur, and a cylindrical brush, that has the same diameter and rapidity of rotation as the beater, removes the greater part of sand and sawdust from the fur. A brush similar to the last, making five hundred revolutions in a minute, and rotating in a contrary direction, finishes the robe perfectly, as it brushes the hairs down as they naturally grow.

Mr. James M. Collier, of Gadsden, Ala., has patented a device by which the grinding stones of mills may be easily adjusted to their proper positions, and may also be easily placed in convenient position for dressing. The grinding mill consists of a lower stationary stone and an upper or runner stone placed in a suitable frame, and having proper devices for adjusting and shifting them. The runner stone is cylindrical, and is placed vertically over the under stone, which is concaved on its upper side to receive and fit upon the runner. This stone rests in a rack in which it is adjusted by set screws. By suitable devices, operated by a hand wheel, the lower stone may be adjusted closer to or farther from the runner, to grind the grain finer or coarser. The frame to which the bearings of the shaft of the runner are attached is so constructed that the frame and stone may be thrown forward to give convenient access to the face of the lower stone for dressing.

Mr. Joseph M. Jones, of Paris, Ky., has recently patented an improved handcart. The axle and wheels are of the ordinary construction. Upon the top of the side pieces of the frame of the cart are runner bars that are raised a short distance from the surface of the side bars by means of downward projections formed on their ends, and at the middle they are supported by eyebolts that screw into the side bars. The body or box of the cart is secured to the runner bars by clips, through which the bars pass, and within which friction rollers are journaled, and is secured in any desired position on the runners by chains, and the body is moved along the runners by handles secured to it.

Mr. John Johnston, of New York city, has patented an improvement in elevators and dumb-waiters which insures their perfect operation and places them under control at all times. A series of friction rollers, over which the suspension rope passes, are grooved for the rope, and work in contact with each other, so that there is sufficient holding friction to support the car or waiter. Grooved guide rollers are placed at the sides of the contact rollers, and below them all is a guide roller for holding the rope at the middle of the well. At this end of the suspension rope is the car, and at the opposite end is a balancing weight. The rollers are turned by their contact in the same direction as they are turned by the rope, and by making the upper roller of larger diameter a difference is obtained between the rotation by contact and the rotation by the amount of rope given, which increases the holding friction.

Mr. George A. Kingsland, of Brooklyn, N. Y., has patented an improvement in foundation curbs for wells. Timbers sawed upon the arc of the required curb, and about six inches wide and three inches thick, are laid in horizontal courses to a height of about four feet. To the outer and inner surfaces of this core are spiked a vertical tier of narrow two-inch planks as long as the curb is high. To these planks are spiked several thicknesses of horizontal boards, about one inch in thickness, care being taken to break joints horizontally and vertically between the boards. To the lower part of the outer tier of boards are spiked iron plates, projecting about four inches below the lower surface of the curb. With this construction the curb and the wall built upon it will descend horizontally, and as the curb descends the edge of the iron plate shaves off the sides of the excavation evenly.

Mr. Frederick B. Spooner, of Brooklyn, N. Y., has patented an improved device for detaching the ring at the upper end of a suspender strap from the suspender buckle. To the front end of an elastic suspender web is attached a fixed metal plate that has a central longitudinal slot, in the upper end of which is secured a spiral spring, having its lower end attached to the upper end of a frame sliding on the back of the fixed plate. A tongue on the sliding frame passes through an aperture on the fixed plate, the upper end of the tongue being bent out to form a hook that checks the downward movement of the sliding frame. The spiral spring holds the sliding frame and prevents the suspender ring from slipping out, and when the frame is pulled down the ring is free.

Messrs. John D. Hanbury and Charles H. Clifton, of New York city, have recently patented suspenders for pants or underskirts, which also serve as shoulder braces to keep the body erect and expand the chest. Two supporting bands pass over the shoulders, and at their ends have devices for fastening them to the pants or skirts, at the front and rear. Each band has secured to it transverse bands that pass under the arms of the wearer, forming arm loops with the upper parts of the supporting bands. A band provided with a buckle is attached at its outer ends to the supporting straps, at the same place to which the arm bands are attached, and a short distance below this point the arm bands are connected by a strap provided with an adjusting buckle.

Mr. Frederick L. Hemmer, of East Arlington, Vt., has patented an improved frame for bucksaws. The two end pieces of the saw frame are connected at their upper ends by a tie rod, and their lower ends are held together by the saw blade. Just below the tie rod is placed a downwardly curved crosspiece, and below this there are braces reaching from near the center, diagonally down, to about the center of the length of the end pieces of the frame. The adjacent ends of the braces are faced with curved metal plates formed with screw openings that engage with a right and left screw bolt; by this means the braces are moved apart to tighten the saw blade.

An improved fountain pen has been patented by Mr. Francois X. Poznanski, of Paris, France. The ink reservoir has at its upper end a shouldered tube, which supports an elastic tube that is closed at its top to form an air chamber. Above the air chamber is placed a piston head. In the lower end of the ink reservoir is a hollow plug, closed at its lower end, and near this end there is a side opening. The lower end of a rod, bent to form a right angle, projects into the side opening; its upper end extends to the top of the ink reservoir. A tube beveled at its end surrounds the lower part of the plug, and between the tube and the plug the pen is inserted. By a slight pressure of the piston on the air chamber the pen is supplied with ink.

A button that can be readily attached to garments without sewing, and readily removed without injury, has been patented by Anna K. Hawley, of Delhi, La. The button head may be of any suitable form or material. The fastener, which also forms the shank of the button, is a strip of spring metal, doubled upon itself to form a flanged head portion, and its ends are then bent outward to form projecting spring posts. The ends of the posts are again bent outward and backward to form claws. The fastener is secured to the back of the button in any suitable manner, and the posts are passed through an aperture in the cloth and through a slot in a washer back of the cloth, the elasticity of the spring posts retaining the claws over the edges of the washer. To remove the button the claws are pressed together, when the button is drawn off.

An improved gymnastic apparatus has been patented by Mr. William A. Smith, of Wilmington, Del. Two vertical bars, about an inch wide and one-fourth of an inch thick, are bent at their upper ends at right angles to their length, and each bar has a spur on the under side of its bent portion. Their lower ends are bent to form a half-round hook, and the bars are connected at their middle parts by a brace consisting of two bars pivoted to each other at one end, their outer ends being pivoted to the bars. A round bar fits into the hooks at the end of the vertical bars, and the upper portion of each of the bars is covered with rubber or other soft material. In use the upper ends of the bars are hooked over the top of a door frame, the spurs preventing the apparatus from slipping, and the device is used as an ordinary trapeze.

Improvements in washing machines have been patented by Mr. William F. Duvall, of Blanchard, Iowa. Two metallic cylinders are connected at their tops and bottoms by two tubes, and in the bottom of the cylinders are placed large wooden balls. In the cylinders above the balls are inverted sheet metal funnels, their greatest diameter being less than the diameters of cylinders. These funnels or beaters are reciprocated in the cylinders by any suitable means. In use the wooden balls are placed in the bottom of the cylinders. The water, soap, and clothing to be washed are then placed upon the balls, an equal amount of clothing being placed in each cylinder. The beaters are then to be placed in the cylinders and reciprocated, when by the peculiar action of the different parts the clothes are quickly and effectively cleansed.

Mr. William C. Siffken, of Victoria, British Columbia, has patented an artificial fuel that is made of cheap and otherwise useless materials. The invention is a composition consisting of ordinary coal screenings, clay which is free from sand, sawdust, and water. This composition is thoroughly mixed and pressed into moulds so formed that apertures are formed in the cakes to facilitate the passage of air and prevent smouldering. While this fuel may not be so well adapted for kindling as the artificial fuels heretofore employed, it has the advantage of utilizing waste materials in an inexpensive way, and at the same time serving the purposes of the cheapest natural fuels.

The object of an invention recently patented by Mr. Wesley H. Dunn, of Bellwood, Pa., is to provide a device to prevent lamp chimneys from being cracked by sudden changes of temperature. The device is formed of two curved metal strips pivoted to one end of a metal rod. The ends of these strips are secured to the top of a lamp chimney in such a manner that the metal rod projects downward. The strips and rod are heated by the flame of the lamp, and as they are of metal they retain heat much longer than the chimney. If the light is extinguished and the chimney tends to cool off rapidly the heat passes from the rod and strips to the chimney and prevents rapid cooling and consequent cracking.

An improvement in the class of carriage tops that fold back when not in use has been patented by Messrs. Conrad and Gottfried Gross, of Richmond, Va. The top is composed of two sections, the front section being connected to the posts in front of the door by hinges, and the rear section is connected to the rear posts in the same manner. The front posts have at their lower ends studs that are secured in sockets in the upper edge of the body. The rear posts are hinged to the body, and when the top is lowered they lie in recesses in the body. The front posts are hinged to the rear section of the top by a double hinge secured to the inner sides of the posts and top. To lower the top the studs of the front posts are released and the posts are raised up parallel with the front section of the top. This section is then raised until it is vertical, and the rear posts are pushed back and the top falls.

An invention that provides a substitute for telegraph poles and light towers has been patented by Mr. William Beeson, of Miles City, Montana, and consists in supporting telegraph wires, electric lights, etc., by means of gas-inflated metallic chambers or floats of sufficient size and buoyancy to float and sustain them in midair. The float is held by suitable stay wires or ropes, that lead to the ground or to some object on the ground. The float is pointed at one end, and has a vane to keep it headed to the wind at its opposite end, and is attached by wires to a swivel by which it is permitted to turn. Between the swivel and the ground supports is a coiled spring, which saves the supports in strong and sudden winds. Between the coiled spring and the ground crossheads are attached for holding the wires to be supported.

Mr. Benjamin F. Brown, of Houghton, Mich., has recently patented an improved sleigh knee, by which construction and repairing of sleighs are greatly facilitated. The knee is cast of malleable iron and made hollow, and has a horizontal projecting flange at a little distance from its upper end, the upper end of the knee being designed to enter a recess in the under side of the beam to relieve the fastening bolts from strain. The lower end of the knee rests upon a plate placed upon the runner, and is flared in front and rear, and has flanges that extend over each side of the runner to receive bolts that secure it to the runner and beam. The rave of the sleigh is bent downward in front and rear of the beam, and its ends are secured to the upper sides of the runner. Should the knee be broken it can be readily replaced with a new one without taking the sleigh to a mechanic.

Mr. William H. Williams, of Bristol, N. H., has patented an improved oiler, by which the loss of oil for lubricating the bearings of shafts is prevented. The oil vessel is suspended from the bottom of the bearing, and contains a tube carrying a wick which conducts the oil from the vessel to the lower part of the inner surface of the bearing The bearing may be provided with a longitudinal slot to receive the wick if desired. The oil is drawn from the vessel up to the bearing by the wick, and there is no waste, as no more oil is fed than is required. The part of the wick immersed in the oil may be as small as a twine, and pass into an opening next to the bearing and be enlarged to give oiling surface, and the wick tube may be adjusted in the casing of the oil vessel by means of a set screw or other adjusting devices.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Engines, 10 to 50 horse power, complete, with governor. $250 to $550. Satisfaction guaranteed. Six hundred in use. For circular address Heald & Morris (Drawer 98), Baldwinsville, N. Y.

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Mr. T. D. Lockling, care U. S. Consul, Panama, U. S. Colombia, will sell the whole or a portion of his patent for umbrellas, illustrated on p. 82, this volume.

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American Fruit Drier. Free Pamphlet. See ad., p. 110.

72" Independent 3 Jaw Chucks, $42; 48", $36; 24", $30. *Warranted* best in the world, and sent on trial. American Twist Drill Co., Meredith, N. H.

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Drop Forgings of Iron or Steel. See adv., page 109.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N. Y.

Paragon School Desk Extension Slides. See adv. p. 109.

Brass & Copper in sheets, wire & blanks. See ad. p. 109.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

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Draughtsman's Sensitive Paper. T.H. McCollin, Phila., Pa.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 108.

See New American File Co.'s Advertisement, p. 110.

Combined Concentric and Eccentric Universal and Independent Jaw Chucks. The Pratt & Whitney Co., Hartford, Conn.

Steam Pumps. See adv. Smith, Vaile & Co., p. 109.

Books for Engineers. Catalogues free. E. & F. N. Spon, 44 Murray Street, New York.

The Berryman Feed Water Heater and Purifier and Feed Pump. I. B. Davis' Patent. See illus. adv., p. 93.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 94.

Bostwick's Giant Riding Saw Machine, adv., page 93.

Red Jacket Adjustable Force Pump. See adv., p. 94.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 94.

Woodwork'g Mach'y. Rollstone Mach. Co. Adv., p. 92.

4 to 40 H. P. Steam Engines. See adv. p. 94.

Drop Forgings. Billings & Spencer Co. See adv., p. 77.

Cope & Maxwell M'f'g Co.'s Pump adv., page 77.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 14.

Small articles in sheet or cast brass made on contract. Send models for estimates to H. C. Goodrich, 66 to 72 Ogden Place, Chicago, Ill.

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Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) C. C. asks: 1. How to recrystallize nitrate of silver crystals? A. Dissolve the silver nitrate in a small quantity of hot water in a shallow porcelain dish, and let the liquid evaporate slowly in the air. 2. Where can I find the action of the Holtz electrical machine explained? A. Consult any recent elementary work on physics. 3. How many cells of the Bunsen battery are necessary for an electric light to light a small room? A. It depends a good deal upon the nature of the lamp employed. Thirty cells can be made to produce a good light.

(2) T. S. asks: 1. How much power would it require to drive a boat 16 feet long, 3 feet deep, and 8 feet wide? How much difference would it make to have it 2½ feet deep, with a screw propeller? A. An engine about 3½ inches by 3½ stroke, for driving propeller. Two and a half feet is deep enough. 2. How many men would it take to make a one horse power? A. Six men are usually allowed.

(3) Mrs. E. R. B. writes: I have seen descriptions of nickel plating in the SCIENTIFIC AMERICAN, and I would like to nickel plate some steel or brass knives and forks. But the description was not explicit enough for me to try it. Can you give the process, or tell me how to get full directions? A. See electrometallurgy, in SUPPLEMENT, No. 310.

(4) E. G. T. asks (1) for a cement for joining wood and iron, as to fasten in the ends of spring curtain rollers. A. Try the following: Melt together equal parts of gutta percha and shellac. Use hot. It should be well mixed together and not overheated. 2. Is there any solution with which to saturate paper, and having been dried, to be changed in color by the passage of electricity? A. Paper charged with colorless potassium iodide and starch is sensitive to the passage of electricity. Paper charged with ferrocyanide of potassium and in contact with an iron stylus or needle becomes colored (blue) by the passage of electricity through it from the latter.

(5) T. J. N. writes: I have two gallons of old gold solution. By precipitating the gold with muriatic acid, can I add it to the new solution? They are both cyanide solutions. If not, how can I get the gold out of the old solution? A. To obtain the pure metallic gold from the old bath add a slight excess of muriatic acid, heat nearly to boiling (under a hood or out of doors to avoid poisonous gases evolved) then add a strong solution of copperas (iron sulphate), until no further precipitate forms. The precipitate is pure gold. When washed in hot water it may be redissolved in aqua regia (nitric acid 1, hydrochloric acid 3 parts), and the solution evaporated to dryness over the water bath. This yields gold chloride, which may be added to the new bath.

(6) F. P. N. asks: 1. Can hard water be used in the manufacture of vinegar from sweetened water? A. Yes, if not too hard, though soft water is better. 2. Could hard water be softened cheaply so as to be available? A. No. Boil the water and let it cool before using.

(7) E. D. S. asks: 1. How can I construct an electric light for a dwelling house, four burners? A. See "Simple Electric Light Apparatus," in SUPPLEMENT, No. 149. 2. Would I have to use power, and if so, what kind? A. No; though power could be used to advantage. 3. Could I use clock work? A. It is not practicable.

(8) J. O. K. asks: 1. Will you be kind enough to give me a receipt for a durable whitewash for outside work? If such can be had, would also like to use various colors. A. See "A Durable Whitewash," page 52, vol. xlv. 2. Where can the phosphorescent paint be bought, and is it costly? A. Address any large dealer in paints and colors. 3. Would the paint show distinctly on a sign at night? A. It would not shine, but would glow quite distinctly if properly applied.

(9) R. D. asks: Will you please inform me, through inquiry column in SCIENTIFIC AMERICAN, what is used to give dark bronze the black appearance? The indented part of the bronze is dark and the surface is polished. A. Cleanse thoroughly the parts to be colored and moisten them with a solution of equal parts of perchloride of iron and copper dissolved in a small quantity of soft water. Rinse in water and repeat if necessary.

(10) J. W. F. writes: I have a new laboratory table made in my recitation room for use in chemical and physical experiments. The top is pine, and I wish to finish it in some inexpensive way to resist acids, etc., that may come from chemical experiments. I would like to finish the table in the color of the wood or a light color if possible. I have heard that in some laboratories the tables are simply coated several times with linseed oil, I do not know whether boiled or not. Will you be so kind as to tell me whether the oil (boiled or raw) will answer my purpose? If not, what had I better use? A. Linseed oil is a very poor coating for such tables. Good asphaltum or black japan is greatly to be preferred.

(11) L. & S. ask: Please let us know through your columns a good recipe for dissolving aniline dyes for branding boxes, etc., so that the dye will not spread on the wood. A. Dissolve one ounce soap in a pint of hot glycerine, and in this dissolve the aniline color.

(12) C. M. B. writes: Some time ago there was a receipt for court plaster published in your paper. It was something like this (I recall from memory): French isinglass, 1 ounce; warm water, 1 pint; glycerine, 1 ounce; tincture of arnica, half an ounce. I prepared some of this but not with entire satisfaction. Can you give us a receipt for a plain court plaster that will not split and remain flexible? A. Soak isinglass in a little warm water for twenty-four hours, then evaporate nearly all the water by gentle heat. Dissolve the residue in a little proof spirits of wine and strain the whole through a piece of open linen. The strained mass should be a stiff jelly when cool. Stitch a piece of silk or sarsanet on a wooden frame with tacks or thread. Melt the jelly and apply it to the silk thinly and evenly with a badger hair brush. A second coating must be applied when the first has dried. When both are dry apply over the whole surface two or three coatings of balsam of Peru. This plaster remains quite pliable and never breaks.

(13) E. G.—The Government method prescribed for cleaning brass, and in use at all the United States arsenals, is claimed to be the best in the world. The plan is to make a mixture of one part common nitric acid and one-half part sulphuric acid in a stone jar, having also ready a pail of fresh water and a box of sawdust. The articles to be treated are dipped into the acid, then removed into the water, and finally rubbed with sawdust. This immediately changes them to a brilliant color. If the brass has become greasy, it is first dipped in a strong solution of potash and soda in warm water, this cuts the grease, so that the acid has free power to act.

(14) J. G. asks: 1. How can a concentrated solution (in water) of soda bicarbonate or soda sulphate be kept in a tin pot without any alteration of the pot and solution? A. A tin or tinned iron vessel is not suitable for such purpose. Better use a lead vessel or line the tin with lead foil. 2. How long can the vulcanized India-rubber endure the action of sulphuric acid (commercial) or fresh carbonic acid? A. If the sulphuric acid is cold possibly half an hour; carbonic acid acts very slowly on hard rubber. 3. Is bicarbonate of soda completely soluble in three times its weight of cold water? A. The commercial salt requires in practice more nearly 4 or 4½ parts of water at 60° Fah., for its complete solution. 4. Why in the Matthews apparatus for soda water do they use marble instead of cheap bicarbonate of soda? Is it only a question of economy? A. Marble dust is very much cheaper than the bicarbonate of soda. 5. If a cylindrical bar pass through a cylindric ring of India-rubber which fits exactly at the bar, and the India-rubber is kept in place by forming a strong pressure over the bar by a metallic cylinder, can a gas at 150 pounds pressure pass between the bar and the rubber although the bar is kept turning? A. If the rubber packing is properly put in and fits the bar well it will retain the gas—for some time at least—according to the wear of the moving rod or bar.

(15) C. H. A. asks: What part of an iron mooring chain is likely to rust most, that which lies close to the bottom or that part which is near the surface of the (salt) water? A. That which receives the surface wash.

(16) "Inquirer" asks: Will you inform me what things a fireman on a locomotive has to attend to? How old must one be to go as fireman on a locomotive? A. The duties vary on different roads, but he must know: 1. How to make up or start a fire. 2. How to fire, so as to maintain steam with economy of fuel. 3. And to this end he must know how to keep his grate clear and clean. 4. He must learn all the road and signals. 5. How properly to handle the brakes. 6. How properly to clean and oil the engine. 7. Should learn the proper height of water and how best to keep it at that height. 8. Learn to read the steam gauge. There is no fixed age that we are aware of.

(17) H. B. asks: 1. What sized horizontal tubular boiler would be necessary for a small locomotive engine, cylinders 1 inch diameter, 1½ inch stroke? What sized drivers would be best in proportion, and steam pressure per square inch, to insure proper working? A. To have 3 to 4 feet heating surface; drivers 4 to 4½ inches. 2. Does the steam as well as the water enter the glass gauge on boilers; and if so, why does not the pressure break it? A. Yes; because of the small diameter of tube and its thickness. 3. Would a small cylinder made from type metal stand the friction? A. Only for a short time. Better use brass or iron.

(18) S. F. P. writes: I wish to bring soft water about thirty rods from spring to house through a slaty soil. Is there anything better than lead pipe for the purpose? I have a prejudice against lead on account of its poisonous character. I have thought of using plain wrought iron pipe, but am told it will rust out quickly. I have seen heavy lead pipe "rotted" through from outside when placed in contact with small slate stones in a short time. A. The best pipe for your purpose, and one we can recommend, is the plain wood tubes. Lead can be used to advantage only where the water is not to be used for drinking or cooking. Iron rusts out very soon under such circumstances.

(19) E. H. R. asks: Can electricity be stored in the back of a hair brush, the brush of bristles, and its flow induced by the contact of the brush with the human body? A. No; but brushes have been made carrying a small galvanic battery in their backs, with metallic conductors or poles arranged to deliver slight electric currents upon the scalp, when the brush is applied to the head.

(20) W. H. J. asks: Can you give me the portions of articles used to form the black wax used by engravers for filling engraved letters on metal show plates, or if it can be purchased already mixed, and where it can be obtained? A. It is prepared by melting and boiling asphaltum until it begins to harden (when cooled on the test stick), and then adding well boiled linseed oil with about 5 per cent of litharge. It can be purchased from almost any large dealer in painter's supplies.

(21) G. L. G. writes, in answer J. M. F., who asks how to soften and harden rubber: Rubber rings or pipe stems of either rubber or horn can be bent any desired shape by oiling the part to be bent with fish oil (or any kind of oil will answer), and then holding it over a lamp until it is heated thoroughly, when the part will be found soft and pliable, and should be held in the desired shape until cool when it again becomes hard. Care should be taken not to put the article in the flame or burn it.

(22) J. W. G. asks: 1. Can you give me a recipe for a polish (dry or liquid) to prevent brass from tarnishing or to polish? A. Brass is best protected from tarnishing by coating it with a lacquer. This lacquer is generally composed of shellac dissolved in alcohol—shellac 1 ounce; alcohol ¾ pint. This lacquer is variously colored by tincture of turmeric, saffron, and dragon's blood. 2. Also for stencil for wood work, black, blue, and red? A. For black, dissolve half an ounce of soap in two-thirds of a pint of good glycerine, and add to this a very strong aqueous solution of nigrosine to produce the proper color. For blue, use aniline blue, 6B, in a similar manner. For red, use a strong aqueous decoction Brazil wood with the glycerine and soap, increasing the soap if necessary.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

C. D. B.—It is native magnetic iron sulphide with quartz.—M. R. L.—1. Manganiferous hematite. 2. An alloy of iron with a little copper.—A. K. B.—It is a quartz sand containing much iron pyrites and iron oxide. Not valuable.—R. H H.—It is galena—native lead sulphide—a valuable ore of lead. It contains a trace of silver.—W. A. McF.—The mica according to the sample, is unmerchantable—the laminæ are imperfect and contain crystals of biolite.—W. H. G.—No. 1. Quartz and pyroxene. No. 2. Altered quartzose rock containing a little selenite. No. 3. Red jasper. No. 4. Vein quartz with calciferous clay selvage. No. 5. A ferruginous quartz rock. Nos. 2, 4, and 5 may contain traces of precious metals. Assays will be necessary to determine this.

COMMUNICATIONS RECEIVED.

On the Birth and Death of the World. By W. C.

A Suggested Improvement in Patent Laws. By F. L. H.

On Boiler Explosions. By T. B.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

July 25, 1882,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Air compressing apparatus, E. Hill 261,605
Air compressor, compound, E. Hill 261,606
Air compressor, hydraulic, C. A. Mayrhofer 261,560
Air, reservoir for storing and supplying compressed, E. Hill 261,607
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Bed spring, W. Singleton 261,774
Bedstead, swinging, A. W. Lozier 261,617
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Board. See Ironing board. Piano sounding board.
Boat detaching hook, C. F. C. Morris 261,749
Boiler. See Locomotive boiler.
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Bolt, G. Cruttenden, Jr. 261,588
Bolster spring, S. Ide 261,611
Boots and shoes, lasting, G. Hawkes 261,602
Bottle packing, perforated, F. O. Cody 261,679
Bow, archery, C. A. Howe 261,610
Box. See Coal box. Packing and toy box. Paper box.
Box or receptacle for containing hairpins, toothpicks, etc., M. E. Converse 261,586
Bracket. See Lamp bracket.
Brake. See Carriage brake. Steam brake.
Bridle, blind, J. C. Simpson 261,773
Bullet casting machine, C. M. Burton *et al* 261,582
Cans from filling tables, removing filled, J. W. Van Dyke 261,571

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Capstan, D. N. B. Coffin 261,530
Car coupling, F. Cordrey 261,683
Car coupling, Dennis & Stanton 261,540
Car coupling, R. E. Gray 261,702
Card teeth, method of and apparatus for grinding, G. & E. Ashworth 261,650
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Coffin, T. E. Daniels 261,537
Color, production of soluble alizarine blue, J. H. H. O. Gürke 261,600
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Corset, C. F. Allen 261,647
Corset clasp, G. H. Colley 261,585
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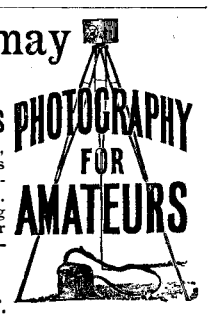
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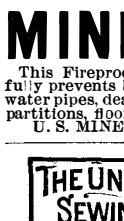

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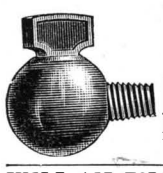

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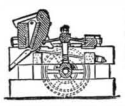

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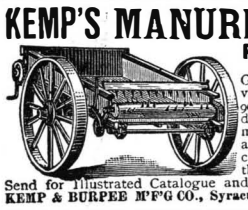

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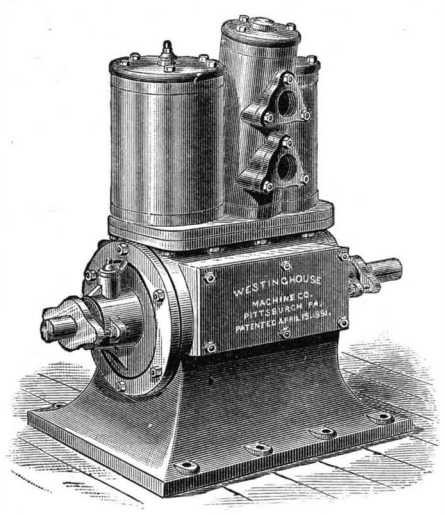

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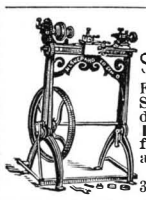

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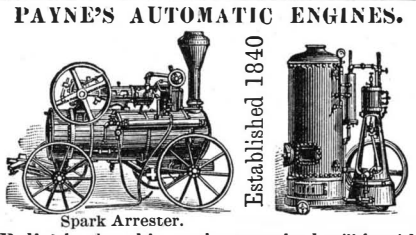

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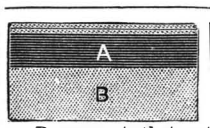

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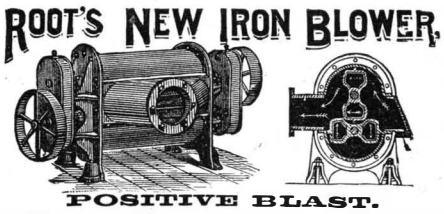

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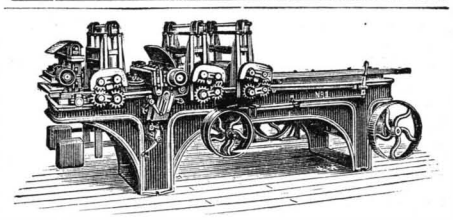

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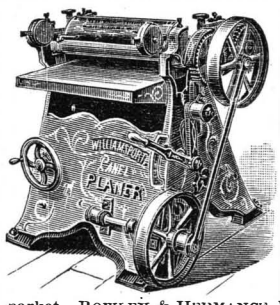

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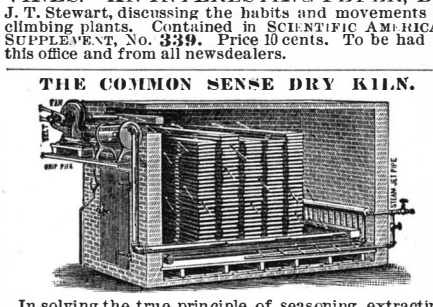

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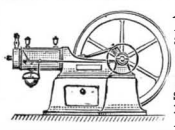

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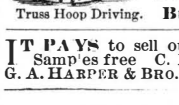

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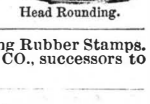

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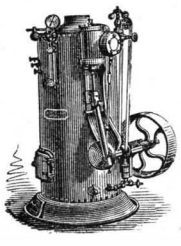

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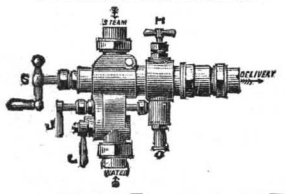

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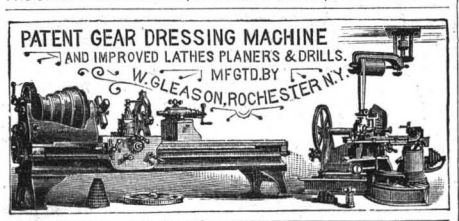

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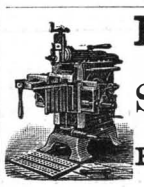

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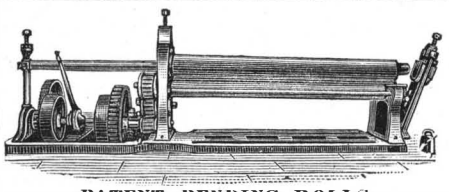

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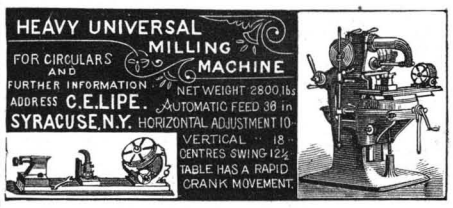
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